THE TELEGRAPHIC JOURNAL AND
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ELECTRIC FIRE ALARMS.

THE recent destructive fire at Messrs. Whiteley's has once more proved the utter inefficiency of the existing means of preventing the ravages of the most destructive of elements. Of the efforts of the London Fire Brigade to cope with the conflagration nothing but praise can be said; had it not been for the energy displayed the dimensions of the area of destruction would have been widely extended. Whether the force of firemen and engines is sufficient for the enormous amount of property it has to protect has been often discussed, and decided in the negative, but the already overburdened taxpayer still hesitates before increasing the burden necessary to diminish the chances of a disaster which may never come home to him. But there are more ways of killing a dog than hanging him, and the question naturally arises—is an increase in the strength of the Fire Brigade the best means of diminishing the destruction by fire which seems to be continually taking place? The fire in the Old Bailey, the other day, resulted in a loss of three lives, whilst the Wood Street, the Paternoster Row, and now the Westbourne Grove, fires have resulted in the destruction of property to the amount of nearly £2,000,000 sterling; such a sum, although covered by insurance, does not, of course, represent the loss incurred in the shape of wages to workpeople, losses which must be severely felt by those concerned. Although an occasional fire may actually benefit the insurance offices by increasing the number of insurers, yet there must be a limit at which disasters cease to be profitable, and we should imagine this limit is being fast approached if not passed, and a few more large fires will force the companies and the public, of which the companies are but a part, to seek for means for preventing such huge conflagrations.

The probable cause of the recent fire, viz., an explosion of gas, at once suggests the thought that, had the lighting of the establishment in question been effected by the electric light, the result which occurred would not have taken place. But, assuming that the use of gas was preferred, an earlier indication of the outbreak (as must always be the case) would have rendered the chances of extinction, before the fire had assumed serious dimensions, immeasureably greater. The street fire telegraphs have done much towards hastening the arrival of the engines, but until means of indicating the existence of smouldering fires, or of an unsuspected increase of temperature, come into general use, the chances of destructive outbreaks must continue very great. It is not that such means do not exist, for automatic fire telegraphs, which will work efficiently, have long been in existence; but whether the public is really unaware that electric fire alarms can be obtained, or whether it is apathetic on the matter, it is difficult to say; certainly practically no advantage whatever has been taken of a means for announcing the outbreak of a fire, which is thoroughly efficient and far from costly. Mr. Edward Bright, in his recent paper before the Society of Telegraph-Engineers and Electricians, exhibited an extremely simple form of "thermostat," which could be fixed at any part of the room of a building at a trifling cost, and which, by closing an electric circuit, could be arranged to sound an alarm at any required point. An improved form of thermostat for the same object, devised by Mr. Pritchett, which we illustrate in the present number, possesses certain advantages over the simpler arrangement devised by Mr. Bright. In fact the whole question amounts to this, that any abnormal increase of temperature inside any part of a building ought, by sounding an alarum, to give immediately unmistakeable evidence of the lurking mischief. The sooner the public recognise this as an axiom the better.

SUBMARINE CABLES.

NOW that the question of underground lines is attracting so much attention, and so much activity is being shown in developing new submarine cable schemes, we think that a paper read before the Society of Arts, more than 25 years ago, by Mr. S. Alfred Varley, will be found of considerable interest to the younger members of the telegraph engineering fraternity.

Mr. Varley, we believe, looks upon his labours of those days, which are fully embodied in the paper to which we allude, as about the best work he has ever accomplished. Be this as it may, the article is full of interest, and we think that its reproduction will be looked upon with favour by the majority of our readers. The title of the paper is "On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions Requisite in a Cable to Insure Rapid and Certain Communication." The author proceeds thus:—

Since the practical realisation of the electric telegraph, several valuable communications connected with the subject have from time to time been laid before this society.

These papers have generally treated of the mechanical details and improvements in the apparatus which have been designed and brought forward by various patentees and inventors.

In the course of the discussions which have taken place it has appeared to me that the principles of the science of electricity have not always been sufficiently appreciated, from not having determined clearly the principles of the science which are involved in telegraphing, and, consequently, the properties which are essential, and must be possessed by all apparatus, to give them a practical value.

This feeling has led me to think that a paper on the Theory of Electricity, keeping always in view its bearing on electric telegraphy, and which should rather treat of the principles of telegraphic apparatus than confine itself to special contrivances, would be subservient to the progress of the object we have in view; for it must not be forgotten that although the world is indebted to the practical man for the application of science to commercial purposes, and, in the case of the electric telegraph, it is even questionable whether we are not indebted for its very rapid extension in part to the inability of the projectors to appreciate difficulties which the philosopher foreseeing would have hesitated at—or, perhaps, to the greater faith possessed by the practical man in the ability of science to overcome

whatever difficulties may present themselves: yet, in the principles of a science, the philosopher is often far ahead of the practical man, and the latter at times comes suddenly and unprepared upon difficulties, which, had he understood correctly the principles long before developed by science, he would have been led to expect as natural consequences. As an example of this, I would mention the case of electric induction, which manifested itself so strikingly when the system of subterranean circuits was considerably extended on the introduction and successful manipulation of gutta percha.

This phenomenon was unexpected and unlooked for by many, though not all, of our practical electricians; and we find it referred to, and regarded at the present time, as a new fact which the electric telegraph has brought to light, and not one to have been anticipated; yet the laws of induction were clearly developed by Dr. Faraday, as far back as 1838; and, when called upon to examine this new telegraphic difficulty, we find him alluding to it in an instructive lecture, delivered before the members of the Royal Institution, as a strong confirmation of the truthfulness of views he had put forth as far back as 1838. I would direct attention particularly to this, because I cannot help feeling that our progress is too often obtained by a laborious perseverance in almost empyrical experiments, until, by the laws of chance, a successful result is hit upon, instead of endeavouring, in the first place, to develop a guiding principle, and referring back to it, as each step forward is made, to test both the truth of the principles laid down and the correctness of the conclusions arrived at. Were this done, experience would not be paid for so dearly; and the commercial application of a science would not be almost paralyzed, as it sometimes is on its first introduction, by the costly series of experiments which have to be gone through before correct principles of working are established.

During March, 1858, the subject of telegraphic cables was very fully entered into by the Institution of Civil Engineers. Finding at that time that there were no papers on the electrical portion before the institution, and feeling that the subject could not be fully considered without the electrical part being entertained, I was induced at the eleventh hour to attempt to supply the deficiency. Some explanation is perhaps therefore due from me for bringing forward, so shortly afterwards, another paper on almost the same subject. Owing to the large number of evenings which had already been occupied in the consideration of the mechanical portion of the problem, and the late hour at which my paper was submitted, it was only read in abstract, and no discussion taken upon it. The views, too, I then brought forward were opposed to some which have lately been laid very prominently before the public, and no opportunity given to contradict them, or to verify their correctness; and as I am convinced that so far from the subject being exhausted its importance is only now beginning to be appreciated, the opportunity having been offered to me to bring the matter before the Society of Arts I determined to avail myself of it.

The complete way in which the subject was taken up by the Institution of Civil Engineers is, however, I am glad to say, already bearing fruit; and since the publication of the papers by the Institution, several valuable discussions have taken place in the scientific journals, and in some of the remarks I have to lay before you to-night, I find, to a certain extent, I have been anticipated.

The generally recognised theory of electricity, as I understand it, supposes all bodies in their normal condition to have two powers or forces resident in them directly opposite in their character and being exactly balanced; in bodies in their natural state these forces are completely neutralised and rendered inactive, producing the ordinary condition of matter.

To these powers the name of electricities has been given, and although we are still as ignorant at the present day as the ancients themselves with regard to what electricity actually is, yet the fact of the existence of the electric telegraph is a proof of the progress which has been made in a knowledge of the laws, at least, which govern electric phenomena.

In the year 1838 Dr. Faraday clearly developed the principles of induction and conduction, since which time no further progress has been made in the fundamental truths of the science, though much has been done to confirm their correctness and to develop their consequences.

In the Philosophical Transactions for 1838 will be found Dr. Faraday's views on the subject of induction and conduction; and these, to my mind, so clearly explain all electric phenomena, that it will be as well at once to refer to them before proceeding further. After giving reasons for his belief in the identity of induction and conduction, he says, "all these considerations impress my mind strongly with the conviction that insulation and ordinary conduction cannot be properly separated when we are examining into their nature, that is, into the general law or laws under which their phenomena are produced. They appear to me to consist in an action of contiguous particles dependent on the forces developed in electrical excitement; these forces bring the particles into a state of tension or polarity, which constitutes both induction and insulation, and, being in this state, the continuous particles have a power or capability of communicating their forces one to the other, by which they are lowered, and discharge occurs. Every body appears to discharge, but the possession of this capability in a greater or smaller degree in different bodies, makes them better or worse conductors, worse or better insulators, and both induction and conduction appear to be the same in their principle and action, except that in the latter an effect common to both is raised to the highest degree; whereas in the former it occurs in the best cases in only an almost insensible quantity.

To determine for myself the law which induction obeys, in conjunction with my brother, Mr. C. John Varley, I have tried some experiments.

The principle upon which these were based was that of the dual character of electricity, and the fact established by Dr. Faraday, that all statical charge is sustained solely and entirely by induction.

In bodies in their normal condition, the opposite forces or electricities being balanced and united, no attraction for neighbouring particles exists, but when these forces are separated, as in the case of a Leyden jar, the attraction which a given quantity of electricity exerts for the similar amount of negative on the opposite coating, will be less in proportion to some law, as the thickness of the dielectric intervening is increased.

It was therefore assumed that the amount of free attraction under these circumstances, or more correctly the amount of induction which would be thrown upon neighbouring bodies, would increase inversely as the attraction between the opposite coatings diminished.

The apparatus made use of was constituted in the following way;—

A glass pillar, varnished, for better insulation, was mounted upon a board. On the top of this a brass plate was attached, and upon this plate the dielectric to be examined was laid. Over the dielectric another brass plate was then placed.

A Leyden arrangement was thus constructed, the upper and lower brass plates representing the inner and outer coatings of an ordinary Leyden jar.

A brass ball, suspended from a balance which had an adjusting arrangement, so that it could be raised or lowered, hung over the upper metal plate at a short distance from it.

The *modus operandi* was as follows:—

The upper brass plate was connected to the earth, and a series of sparks, through the medium of a sliding rod kept at a fixed distance from the prime conductors of a frictional machine, thrown into the lower brass plate of the Leyden arrangements, or the prime conductor was kept fully charged, and a carrier ball attached to a long glass rod was made use of to measure out definite quantities of electricity

The room in which the experiments were performed was heated with a stove, and the dryness of the atmosphere indicated by a hygrometer, so that the insulation might be as perfect as possible.

When a certain number of sparks had been thrown into the lower brass plate, the upper brass plate was disconnected from the earth, and the lower one attached to the balance, and if the tension of the charge was sufficient, the brass ball suspended from the balance was attracted down, and discharge ensued. The experiment was repeated again and again, and the number of sparks requisite to just attract the ball down noted.

Glass plates were the dielectric employed, and the experiment was tried first with one plate, then with two, and then with three plates of glass between the upper and lower brass plates, the brass ball suspended from the balance being kept always at a certain fixed distance from the upper brass plate.

The results obtained from a numerous series of experiments were—that when two plates of glass were placed between the brass plates, only half the number of sparks which were required to raise the tension of charge sufficiently to cause discharge when one plate of glass separated the brass plates was requisite, and when three plates of glass divided the upper and lower brass plates, then a third of the number of sparks raised the charge to the same degree of tension, showing that through flat plates of glass induction decreases in the inverse proportion to the thickness of the dielectric, that is to say, if the induction through one be 12, through 2 it will be 6, through 3, 4, and so on.

In the case of a gutta percha covered wire, it was anticipated that as when the thickness of the gutta percha is increased, the outer surface increases at the same time, the decrease of induction consequent on the increased thickness of the insulating material would not be inversely proportionate to the depths of the gutta percha, but would follow some other law.

To put this to the test, a series of Leyden arrangements were constructed in the following way: Three pieces of tube, of half an inch internal diameter, and 2 feet 6 inches long, were placed in the centre of tubes of 2 feet long, the internal diametres of which were 1 inch, 1½ inches, and 2 inches, and the space between the inner and outer tubes filled with melted resin. (Figs. 1, 2, 3.)

FIG. 1.

Fig. 2.

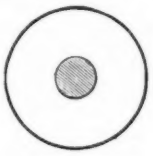


Fig. 3.

By this means three Leyden arrangements, with a uniform internal surface, but whose insulating material varied in thickness in the proportion of 1, 2, and 3 were constructed, and the same process as that already described with the flat plates was repeated.

The results obtained are shown in the annexed table :—

Diameter of Inner Tube.	Thickness of Insulation.	Diameter of Outer Tube.	Inductive Force.
10	5	20	22
10	10	30	15·5
10	15	40	11·5

These results were very constant, but as resin was the only dielectric employed, the experiment requires repeating with other dielectrics, for there is reason to believe that with glass at least the decrease in induction consequent on an increased thickness of the dielectric would be somewhat greater than that indicated in the above table.

The reasons for this belief are the following : When a galvanic battery is connected with the inner and outer coatings of a Leyden arrangement, induction will take place through the dielectric, and if the surfaces of the two coatings are equal, then the force will be equally divided over them ; that is to say, if the battery force be 100, the tension of the charge on the one coating will be 50, and that on the other will be 50 also = 100.

Let the surface of the outer coating be supposed to be infinite in extent, then the tension of the charge on the inner coating will approach infinitely near to 100, and the tension of the charge on the outer coating will be almost nil. An example of this we have when the earth represents one of the coatings of a Leyden arrangement ; and this is the case in the prime conductor of a frictional machine, and also in the suspended wire of a telegraphic circuit ; in these two examples the prime conductor of the machine and the wire of the telegraphic circuit represent the one coating, the air the dielectric, and the earth the other coating.

Now consider a case where the outer surface is double that of the inner one, the tension of the charge on the inner coating will then be double that of the *outer ;* an example of this we have in the above table, where the inner surface is 10, the thickness of the insulation 5, which may here be regarded as unity, and the outer surface 20—the battery force being 100. Divide this into three parts, and we get 33·33. Give two parts for the tension of the charge on the inner coating, and one part for the tension of the charge on the outer coating, then we shall have for the tension of the inner surface, 66·66 ; for the outer surface, 33·33 = 100 when united.

Now, consider the third example in the above table. Inner surface 10, thickness of insulation 15, outer surface 40, or quadruple that of the inner surface. In this case the tension of charge on the inner surface will be four times that of the charge on the outer surface. In other words, the tension of the charge on the smaller surface will be 80, and that of the outer surface 20, the united tensions equalling 100 ; but the thickness of the insulation is 15, or three times that of the first example ; and it has been shown that induction decreases in the inverse proportion to the thickness of the insulating material ; we shall therefore have to divide by 3, and this will give 26·6 for the tension of the charge on the inner service.

In the first example it has been shown that if the force be 100, the tension of the charge on the inner surface will be 66 × 66·66. In the actual experiment the inductive force measured was 22 ; 67, therefore, represents 22, and as 67 is to 22, so should be 26·6 be to the amount of force which would be expected to be obtained in the last example. This, when calculated by a simple rule of three sum, gives 8·78 for the amount of inductive force. In the actual experiment the force obtained was 11·5, a result sufficiently near to warrant further investigation, to ascertain whether the law which would seem to be indicated is correct, and whether it holds good with any other dielectric, such as glass, in which case the cause of the discrepancy, when resin is the dielectric employed, should be sought after.*

I now proceed to conduction.

The law which governs the conduction of electricity has been very accurately ascertained, and would seem to follow the same law as induction, that is to say, if the sectional area be uniform throughout, the resistance which a conductor will oppose to the passage of a current will be directly relative to its length ; or, the length of the conductor being determined, the resistance will be relative to its sectional area. In other words, a wire one mile long will oppose half the resistance of that which will be opposed by a similar wire two miles long : and two wires, each two miles long, placed side by side, which is the same thing as one of twice the sectional area, will oppose exactly the same resistance as a single wire one mile long.

The next thing to be considered is the part which the

*An explanation is suggested further on in this paper.

quantity and intensity of electric currents play in electric phenomena.

The amount of force developed by an electric current, whether it be the deflection of a needle, the attraction of an armature in an electro-magnet, or the decomposition of water, is always relative to the dynamic quantity flowing.

This fact has been well established, and the difference betweent quantity and intensity accurately defined; yet still, in practice, there is a want of a clear comprehension of the relationship of those terms.

Let a battery—say of 10 pairs of elements, with 10 inches of surface in each cell—be joined through a circuit perfectly insulated, and opposing very great resistance to the passage of the current; and the amount of force, or in other words, the dynamic quantity of electricity flowing, be weighed off by a magnetometer, and noted down. If now this battery be disconnected, and another of the same number of elements, but with twice the surface, be connected in its place, practically no more will be found to be flowing through the circuit than in the former case, the resistance which the wire opposes measuring out the quantity passing somewhat in the same way as the height of the column, and not the quantity of water, in a cistern, regulates the rate at which it flows from an orifice inserted in it.

Let the series be increased, and more will be urged through; and, if the number of cells be sufficiently numerous for practical purposes, the same quantity as a single cell would generate through a circuit of no resistance, will be found to be flowing.

In theory this point can only be approached, for the resistance of the wire can never be completely overcome. In theory, also, when the number of elements is not increased, the larger the surface the greater will be the quantity which will pass, for the tension of the current is lowered in proportion to the amount of electricity flowing out of the battery; and, when drawing from a large reservoir, which batteries of greater surface may be compared to, this same amount will not lower so much the general tension; consequently, there will be more intensity to urge the current through. But to return to practice. If the number of cells has been sufficiently extended so as to generate the same dynamic quantity as a single cell does through a circuit of nominally no resistance, a further addition to the series will not be attended with any beneficial effect, for there is already power enough to urge through all the electricity the battery is capable of generating; and the force developed is directly relative to the dynamic quantity flowing. Tension is only the medium by means of which this dynamic quantity is forced through the circuit.

It will be as well, perhaps, to define more precisely what is wished to be understood by the term resistance. When it is said that one circuit opposes twice the resistance of another, it is meant that the same tension of current will force half the dynamic quantity only through this circuit that it would through one opposing half the resistance; it follows that a given length of wire opposes the same resistance to half the quantity of electricity that half this length of wire does to double the quantity, and hence all circuits oppose to an infinitely small quantity of electricity an infinitely small amount of resistance.

The way in which quantity and intensity affect practical telegraphing has next to be considered, and whether there be any advantage in employing comparatively large over smaller dynamic quantities of electricity.

It may be generally stated that when the insulation is very perfect there is no great difficulty in working with minimum quantities; but when the insulation is imperfect, larger dynamic quantities held out a better prospect of working through.

When a current is flowing through a circuit which offers, practically speaking, no resistance, let the cells of the battery be ever so numerous, it will possess no intensity worth noticing, for, as there is no resistance opposed to the force resident in the battery, the intensity is not brought into play. It is something like a powerful engine raising a light weight, the force is latent, but not brought into action.

Let the battery, however, be connected through a circuit opposing considerable resistance; its intensity will then be developed.

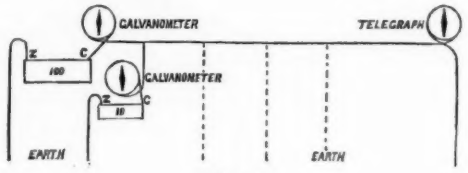


FIG. 4.

Let the diagram (fig. 4) represent a circuit which fulfils these conditions, one end of the wire dipping into the earth in the usual way, and the other connected with the copper pole of a battery composed of a numerous series of elements possessing very little surface and, consequently, capable of generating only a small dynamic quantity of electricity, and let the circuit be completed by connecting the zinc pole to the earth.

(*To be continued.*)

REVIEWS.

The Watch and Clockmakers' Handbook, Dictionary and Guide. By F. J. BRITTEN. London: Kent & Co., Paternoster Row.

The practice of arranging a technical work in the form of a dictionary is in many respects a convenient and useful one. Mr. Britten in the latest edition of his work (which is a very considerable enlargement of the fourth edition) has greatly added to its utility by arranging the matter under alphabetical headings. To those amateurs who have a taste for watch and clock mechanism, the book will be most attractive. In electrical science a knowledge of such mechanism is in the highest degree useful, and for certain branches it is absolutely necessary. As we have more than once pointed out, workshop instruction in science schools ought to include at least elementary tuition in watch and clock construction and not be confined, as it at present is, to heavy engineering work almost exclusively. There are several text books which deal exclusively with the subject, but Mr. Britten's is one of the best of them.

Workshop Receipts (Third Series). by C. G. WARNFORD LOCK. E. & F. N. Spon, 16, Charing Cross.

Messrs. Spon, who have so long had the lead in the publication of works of a practical scientific character, have done great service in bringing out the series of "Workshop Receipts." The present volume deals largely with electrical and metallurgical matters, and is, therefore, very acceptable at the present time. Considering the large scope of the volume, the amount of information which has been compressed into the available space is very considerable. Some of the matter inserted, however, has evidently not received any consideration as to its practicability; for example, on page 70 we have described an electrical water level indicator which those who are practically acquainted with the subject can see is absolutely useless for the intended purpose; the apparatus has evidently been designed by some one who has never had a model of the same made. This practice of inserting matter without the compiler being certain whether it is correct or not is unfortunately a very common one, though to a great extent, no doubt, it is unavoidable. The metallurgical articles in their practical features are much ahead of those contained in any existing work, indeed, the whole book shows signs of a desire of the author to be well up to date, and in this, we think, he has been to a very great extent successful.

Le Hammer-Telephone. Par L. DE LOCHT-LABYE. Paris : 9, Rue des Sts-Pères.

This is a pamphlet of 48 pages, describing fully the so-called "Hammer"-telephone of M. Locht-Labye, of which we gave a description some time ago in the pages of the REVIEW. The author commences his pamphlet by stating that the instrument is based on "principles directly opposed to those which have been universally admitted up to the present time." The author has argued the question in an able manner, no doubt, but we do not think that his arguments will carry conviction except to the few.

THE LATE PROFESSOR J. B. DUMAS.

IT will be known to the majority of our readers that the illustrious chemist Jean Baptiste Dumas concluded his long and brilliant career on the 11th of last month. At his funeral, according to the graceful French custom, discourses on his discoveries and on the lessons of his life were delivered by M. le Compte d'Haussonville, on behalf of the French Academy ; by M. J. Bertrand, his colleague in the perpetual secretaryship of the Academy of Sciences ; by M. Rolland, President of the Academy of Sciences, and by M. Wurtz, on behalf of the Faculty of Sciences and the Faculty of Medicine of Paris.

Count d'Haussonville particularly signalised the public speeches of the deceased, learned without pedantry, and animated with a natural eloquence which flowed as from a fountain. On one occasion it became his duty, as Government Commissioner, to ascend the tribune at the Chamber of Deputies and, with reference to a Bill then in discussion, to explain the entire mechanism of coining money. In spite of the dryness of the subject, the entire audience listened to him eagerly for two hours.

M. Wurtz gave a short sketch of the life and the discoveries of his departed friend. Dumas was born at Alais as far back as 1800, and thus formed one of the few remaining links between the science of the present day and that of the first half of the 19th century. In his youth he occupied a position in the shop of a pharmaceutical chemist at Geneva. He was scarcely twenty years of age when, in association with Prevost, he published researches on various physiological questions, and especially experiments on blood. On his arrival in Paris, in 1821, he devoted himself exclusively to chemistry and was soon in a position to undertake successfully the most important investigations. He opened up the era of the independent development of organic chemistry and of the reform of mineral chemistry. If during the last 50 years chemistry has entered upon new paths and has been transformed under our very eyes, this is due to the realisation of a programme which Dumas was the first to trace and for which his discoveries furnished the foundation. The theoretical ideas then current were drawn from the relatively simple study of mineral compounds. All combinations were supposed to be formed of two immediate elements, simple or compound. The great Swedish chemist Berzelius who, at the beginning of the century, exercised an uncontested authority, had adopted and developed this conception which dates back to Lavoisier, and which he supported by the electro-chemical hypothesis. This was what is called "dualism" in chemistry. It was demolished by Dumas. Whilst studying in 1834 the action of chlorine upon organic compounds, he perceived that this elementary body possessed the "singular property of seizing hold of hydrogen and of replacing it, atom for atom." Such was the first announcement of a law which is now based upon thousands of analogous cases, and which forms the starting-point of the theory of substitutions and of its consequences. M. Dumas, in conjunction with Laurent and Gerhardt, was the head and the support of the new school, just as Berzelius was its opponent from the very outset. The idea that an electro-negative element like chlorine could take the place of hydrogen —a body essentially electro-positive—shocked him in his firmest convictions. In fact, it overthrew the dualist system. It involved a new manner of regarding chemical compounds. To Berzelius, they appeared as double entities ; to Dumas they were unitary structures, the materials of which were arranged in a certain manner, but which remain unshaken if one stone, or one course of stones is replaced by another. This conception was developed by Dumas in a series of classical memoirs.

In the meantime he ignored no department of chemical science. He discovered and described new compounds, both mineral and organic ; he analysed numerous bodies, improved the analytical methods, and determined atomic weights, evincing everywhere that penetration and inventive genius, that accuracy, both of manipulation and of judgment, that exactitude in details, and that critical spirit which are the necessary conditions in scientific research. The compounds which he discovered are not isolated, desultory bodies, they are representatives of certain general properties.

Amongst the separate publications of Dumas we may especially mention his great *Traité de Chimie appliquée aux Arts* ("Treatise of Chemistry applied to the Arts") and that incomparable volume *Leçons de Philosophie Chimique.*

To his early physiological researches we have already referred. But later, he endowed physics with a new method for the determination of vapour-densities, thus following in the footsteps of his master, Gay-Lussac.

His career as a professor is no less worthy of note. Upon his arrival at Paris he opened a course of lectures at the Athénée. Subsequently, in conjunction with Lavallée Ollivier and Pèclet, he founded the Central School of Arts and Manufactures, where he filled the chemical chair for a quarter of a century. In 1832 he succeeded Thénard at the Ecole Polytechnique, and the same year he was called as "adjunct professor" to the Faculty of Sciences at Paris. In 1841 he became at once titular professor and dean of faculty, and three years previously he succeeded to the chair of organic chemistry at the Faculty of Medicine, where he opened up a new era and gave an impulse which has not been lost. His teachings introduced into physiology the use of the exact methods of chemistry and physics and the habitude of scientific reasoning.

It may not be irrelevant here to mention that among his pupils ranks the deservedly celebrated M. Pasteur.

Amidst his researches and his educational duties, Dumas found time for certain public avocations. He was president of several international commissions on the questions of the unification of weights, measures and coins, and on the determination of electric units.

Viewing the deceased *savant* from every side, we may pronounce him one of whom his country may with full justice be proud.

THE ELECTRIC TRANSFER OF ENERGY.

RESEARCHES OF M. MARCEL DEPREZ.

Summary of Experiments.

By FRANK GERALDY.

Translated from *La Lumière Electrique.*

(*Continued from page* 351.)

Fig 13 shows that there were three wires ; the two upper served for the power, and the lower for communications. There were at first two telegraphic stations, but even before the commencement of the public experiments there were placed there two telephonic stations on Aders' system, which furnished an extremely convenient means of correspondence, and greatly facilitated the experiments.

We may add that in the public experiments which were made, the use of this telephone was a great attraction. Many persons requested permission to hear it, and at the end of each experiment the public took particular pleasure in seeing the results of the

day exchanged, and orders for the morrow given by means of the telephone.

Fig. 15 gives, on the plan of the neighbourhood of Grenoble, the track followed by the line. Fig. 14* is a bird's-eye view of the country traversed. The line runs in the splendid valley of Gresivaudan, along a promenade named the Boulevard Saint-André, which extends nearly 10 kilometres, almost to the Bridge de Champs. It leaves the torrent of the Drac at its junction with the Romanche, and still following the road, ascends the valley of this latter torrent as far as the cement works. The resistance of this circuit was found to be 170 ohms.

The receiver was in the centre of Grenoble, in an ancient building called the old market-hall, and which was once a church. The site was very large and high, but unfortunately badly covered, as was discovered too late. The upper storey was perforated with large openings, the frames of which had disappeared long ago. In fine weather this was charming, and a delicious coolness pervaded the hall. But in bad weather the cold wind from the mountains, and the rain, raged fiercely. One day it was necessary to break off the public experiments because there fell in the hall nearly as much rain as in the neighbouring square. The engineers' warned by experience, feared lest the machines might get wet. This circumstance is mentioned here in proof that the weather was not uniformly favourable. On the contrary, the work was carried on in rough weather, and even in the midst of a heavy storm. Cold or hot, foul or fine, dry or wet, the machines did not seem affected, and went on always equally well.

Before requiring any work from the machines they were of

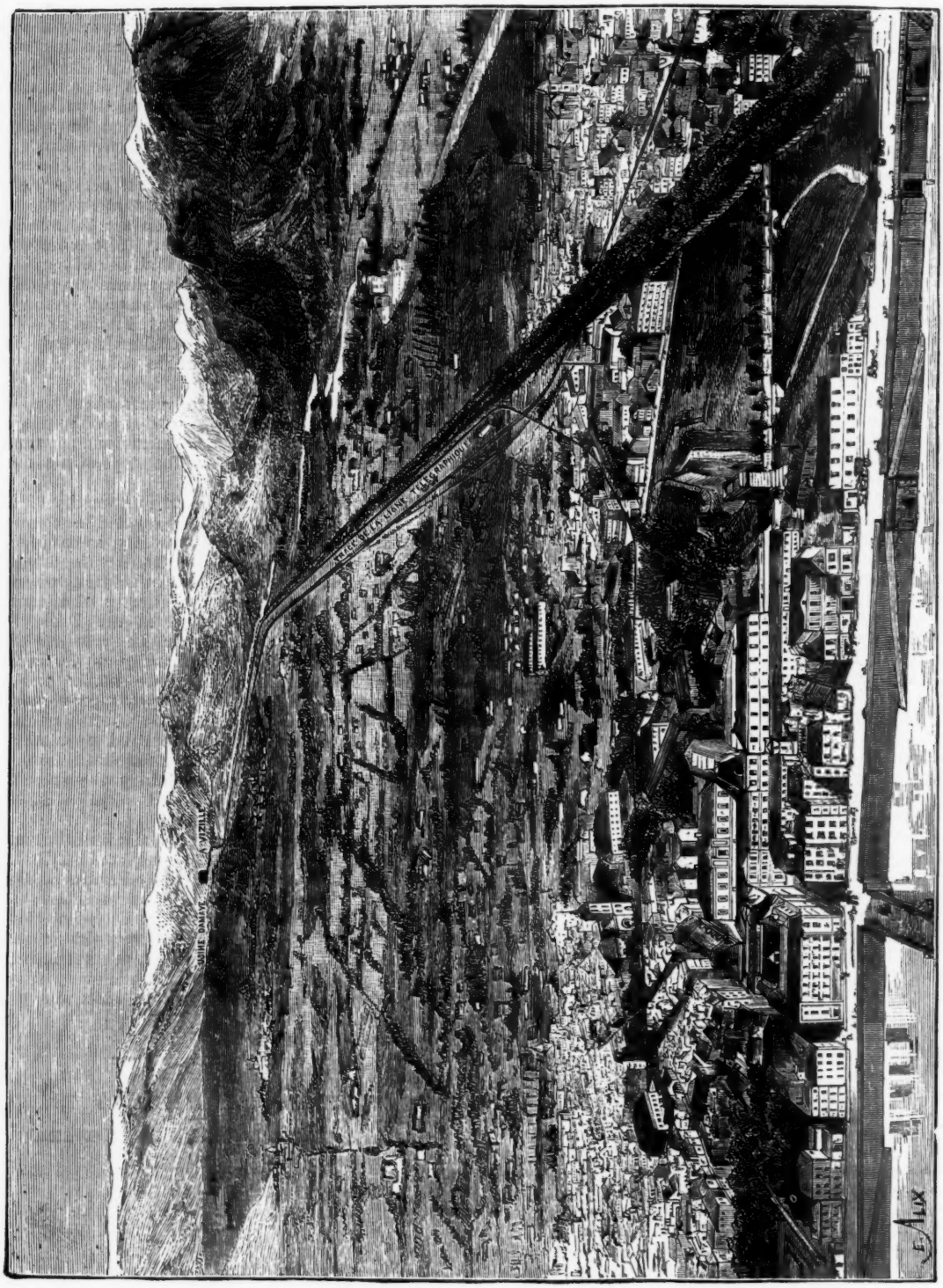


FIG. 15.—BIRD'S-EYE VIEW OF THE TRACK OF THE LINE FROM VIZILLE TO GRENOBLE.

* See p. 350 of last week's issue

course tried. To this effect the receiver was fitted with a Prony brake, and instructions were given to the station at Vizille to start at a velocity of about 500 revolutions, increasing slowly up to 1,200 or 1,300, which speed was to be kept up, and to work for an hour, unless a signal to stop was sent from Grenoble.

The trial gave full satisfaction. We saw with pleasure the work received rising from 3 to 4, and then to 5 horse-power, thus exceeding former results, and then still increasing to about 7 horse-power, at which it remained during the whole time of the experiment.

It was then certain that the machines were in very good condition, that they were doing excellent service, and that they could be depended on.

To begin with, the receiver was merely set to work a rotatory pump, feeding a cascade. Under these conditions it was far from exerting its entire force. They worked at a low speed at Vizille, and about 2 horse-power were received at Grenoble. This was a pretty experiment, fit to interest the public. We proceeded thus daily for about a fortnight, from 2 to 4 p.m., during which time the Municipal Commission was organised.

A commission had been nominated to watch the experiments. The Mayor of Grenoble, desirous of complete information, had chosen a number of engineers, and having assembled them under the presidency of Captain Boulanger, had commissioned them to furnish a report.

A practical study was especially wanted. Exact information was required on the forces transmitted and expended; on the the regularity of working on the industrial possibilities; the

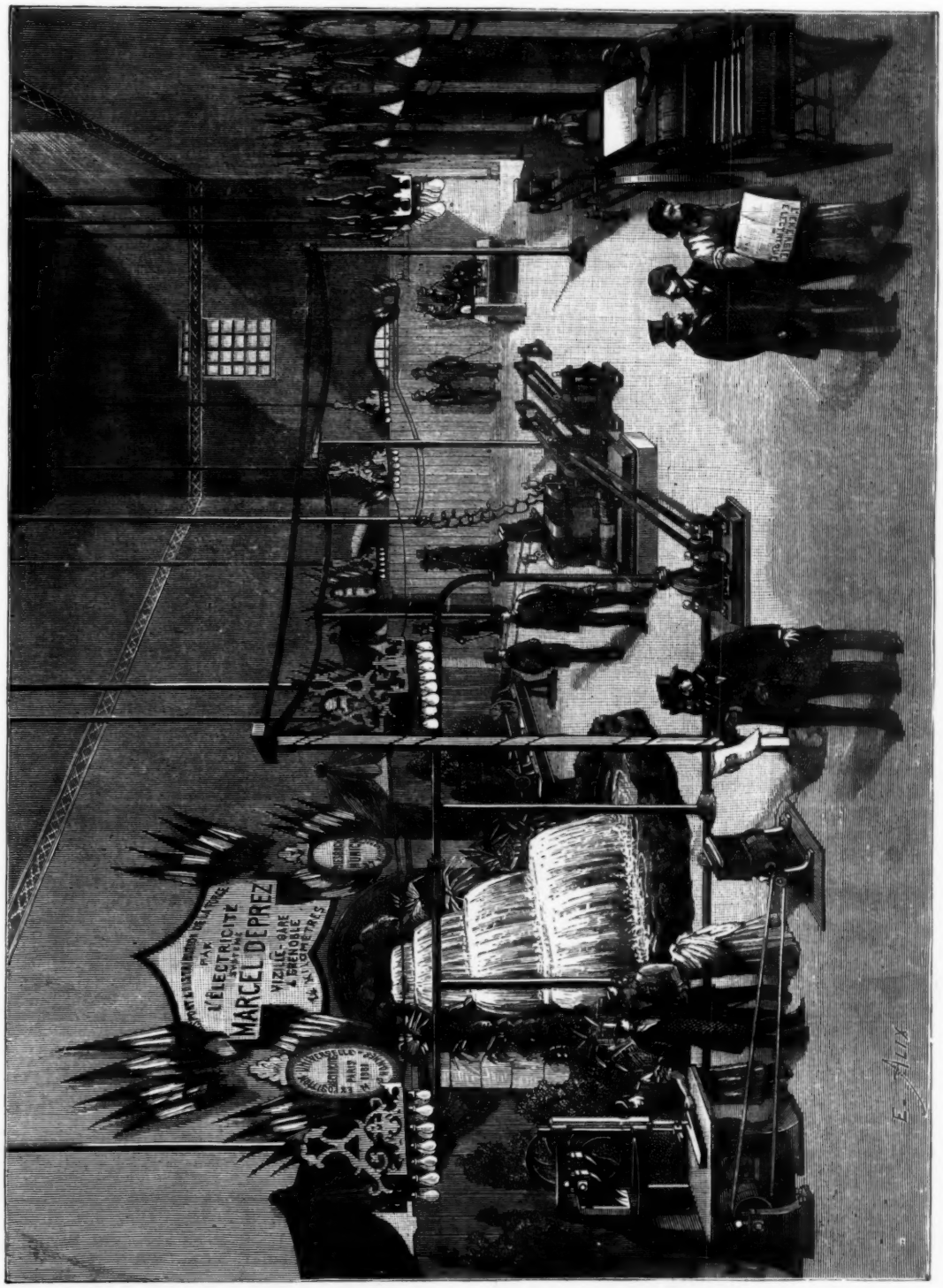


FIG. 16.—INSTALLATION AT GRENOBLE.

electric data were regarded as interesting, but secondary; the means were not so much the object of inquiry as the results.

Above all, dynamometric measurements were to be taken. At the arrival station this involved no difficulty; the Prony brake which had been used on the North of France Railway, having been refitted, was used again. At the departure station the difficulty was greater; we had there no transmission-dynamometer. These instruments are very rare. Further, it must be said the one which had been used on the North of France Railway, and which could at need have been procured, was not thought fully trustworthy. It had been constructed for moderate velocities, and when set in action at the speeds which the electric machines require, it only admitted of registrations of a very short duration, at most 30 seconds. The Grenoble Commission purposed making less rapid studies. There might be an advantage in a change of method, and recourse was therefore had to a process of substitution. The commission has given in its report a detailed account of this means. It is in principle as follows:—On the transmission-shaft, moved by the turbine, there was placed a Prony brake. Its position is shown in fig. 10,* and its appearance is represented in fig. 17. This apparatus, which is very strong, was in constant action, moistened by a stream of water mixed with oil and soap. Its friction was thus rendered very constant, and it worked with great regularity. Its sensitiveness was ascertained by dint of very precise experiments.

The turbine was then set in movement; its work was completely absorbed by bringing it to a given speed, the electric machine being disconnected up to this moment. The *régime* being once established, the generator was connected, and by taking away weights from the scale of the brake, the velocity was brought back to the same pitch. The total work did not vary, as the turbine remained in the same condition. Consequently, the weights removed from the brake represented exactly the portion of the total work absorbed by this machine.

There were three series of operations on three different days; each of them occupied an entire day. The speed of the machine being varied within very wide limits. About three operations were made hourly, each of them lasting about twenty minutes. It was no longer a question of computations taken rapidly, as in the experiment on the North of France, but of serious and prolonged examinations. We give below the table of the last experiments, which were naturally the most precise.

It will be seen how superior are the results to those obtained on the North of France Railway.

The resistance of the circuit was about the same, but it was represented by a longer line, exposed, consequently, to more chances of loss.

As this question of losses on the line had been a great subject of discussion on which precise information was wanting, a direct experiment was made to show what was the value of the losses. For this purpose there were employed voltameters with plates of silver and nitrate of silver—a very accurate method. It was found in two successive experiments that the mean proportion of these losses was, in round numbers, 5 per cent., which is a very reassuring result, and when in the experiments on the North of France these losses were considered as admitting of being overlooked, it is certain that a proportion of this kind was understood. It is in fact a loss which may be considered as without practical influence upon the working of the apparatus.

Number of Experiment.	Revolutions of Generator.	Motive Work transmitted to the Generator.	Revolutions of Recipient.	Available Work collected at the Recipient.	Yield.
H 1	780	6·97	484	3·30	47·3
H 2	730	8·20	446	3·55	43·2
H 3	732	8·96	406	3·69	41·1
K 1	865	8·39	614	4·19	50·3
K 2	865	9·82	586	4·66	47·4
K 3	875	11·05	558	5·08	45·9
L 1	946	8·40	712	4·86	57·7
L 2	954	10·10	686	5·46	54·0
L 3	970	11·46	662	6·92	52·5
M 1	1,040	9·69	830	5·66	58·3
M 2	1,040	11·08	778	6·19	55·8
M 3	1,050	12·33	734	6·68	54·1
N...1	1,127	11·18	875	6·97	62·3

(To be continued.)

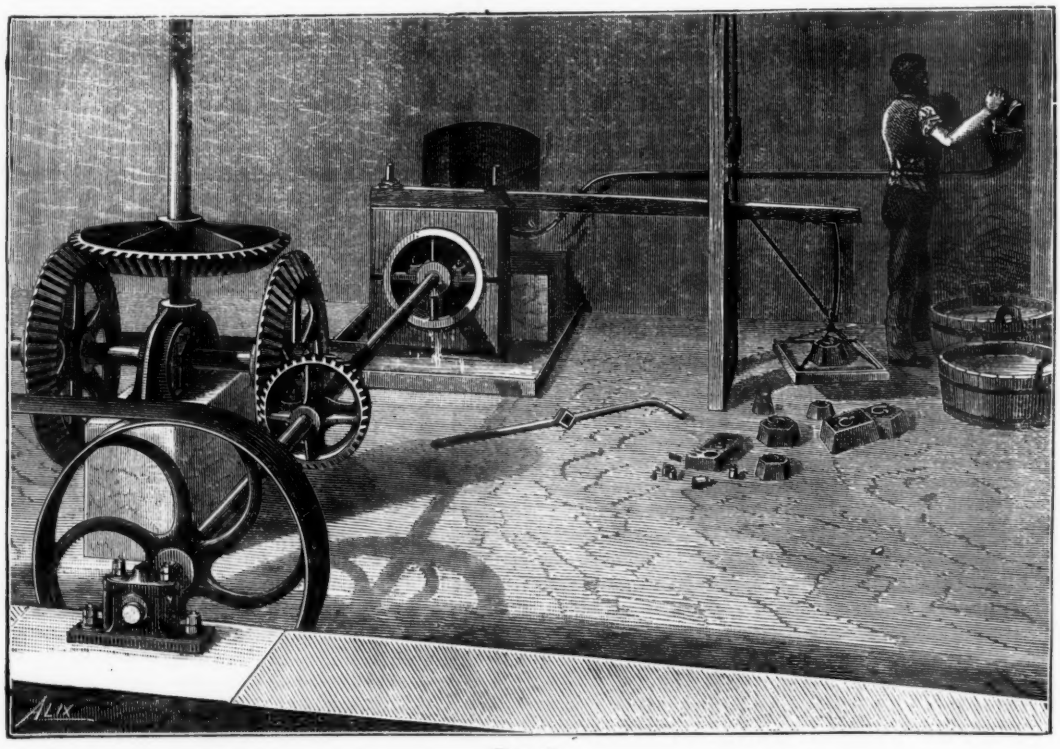


FIG. 17.

* ee p. 326 ELECTRICAL REVIEW, April 19th, 1884.

THE EFFICIENCY OF SECONDARY GENERATORS.

LAST week we published the copy of a letter from M. Gaulard to M. Hospitalier, which was intended as a reply to some criticisms made on the Gaulard-Gibbs apparatus by that gentleman in our excellent contemporary *L'Electricien*. M. Hospitalier has kindly forwarded to us for publication advanced proofs of his comments on M. Gaulard's communication.

We insert M. Gaulard's letter the more willingly because it fully confirms our criticisms on his system, as inserted in *L'Electricien* of April 15th.

If M. Gaulard is not authorised to defend the statements and the figures of Dr. Hopkinson, and if, on the other part, Dr. Hopkinson does not reply directly to our criticisms and to those of our contemporaries the ELECTRICAL REVIEW and *La Lumière Electrique*, it is because there is every reason to believe them well founded. There remain the two points which M. Gaulard takes up: the one relating to our neglect of the second part of Dr. Hopkinson's report, and the other referring to the possibility of effecting by

means of known systems, distributions at distances as great as with the apparatus of MM. Gaulard and Gibbs.

As to the first point, we declare that it is impossible for us to accept the figures furnished by Dr. Hopkinson, and that the report itself has inspired us with distrust.

In fact, after recognising that the electro-dynamometer is open to indisputable theoretical objections for the measurements of alternating currents, Dr. Hopkinson makes use of this very apparatus for determining the yield of the small secondary generator, and wishes us to accept the figure of 86 per cent. found by a method which the author himself admits as faulty. This would be too simple!

If M. Gaulard regrets that we did not bring forward this objection in our article of April 15th, we have now atoned for the omission and we thank him for having given us the occasion.

As regards the second point, M. Gaulard confuses intentionally the distribution and the transfer. This seems to give him some appearance of being in the right, but his calculations are more specious than just, as we are about to show. It is very certain that if it is required to transmit to the distance of 12 kilometres (25 kilometres of line) an energy of 9,060 watts, losing only 36 per cent., or 3,261 watts on the line, and if we are limited to a useful potential of only 100 volts, the conductors will be out of proportion with the result to be attained. We know that in order to transmit much energy to a great distance many volts are required, and M. Gaulard teaches us nothing in indirectly recalling this fact.

Mr. Brush did nothing else with his machines, supplying as many as 40 arc regulators in circuit, and the Siemens machine, which serves as a generator for Mr. Gaulard's apparatus, is arranged for high potentials.

When M. Marcel Deprez last year, at Grenoble, supplied 108 Edison lamps (model B) at the distance of 14 kilometres from the generator at Vizille, he employed currents of an initial electromotive force exceeding 3,000 volts.

Whether the current be continuous or alternating, the objection remains the same; high potentials are dangerous even in a closed metallic circuit, and the experiments cited formerly by M. Gaulard are far from being convincing.

It remains, then, manifest that to go far we must have either many volts or massive conductors: on the one hand there is danger, and on the other expense; but the expense may be reduced in case of a direct distribution without transmission.

If we confine ourselves to distribution, the calculations of M. Gaulard are no longer accurate, because he supposes that the conductors must convey a current of 125 ampères over their whole length. M. Gaulard is aware that in distributions intended to act at a certain distance, Mr. Edison has combined arrangements which, whilst they increase the utilisable potential and raise it to 200 or 300 volts, enable the thickness of the conductors to be considerably reduced,

We persist in our opinion that it would be possible to distribute electric energy over an extensive radius, up to 12 kilometres if needed, with a distribution by derivations, if we agree to a loss of 37 per cent. in the conductors. If it has not been done hitherto, it is because it is repugnant to the good sense of electricians to consent to such a loss. It is thought preferable to restrict the distance and augment the yield by multiplying the centres of production, and keeping within acceptable potentials.

When M. Gaulard speaks of the cost of 25,000 francs, he refers merely to the conductor itself. To make a comparison possible, he must add to the price of the cable that of the five secondary generators, apparatus which would be, of course, dispensed with in a direct distribution.

The contrast made by M. Gaulard between the price of 1,250,000 francs for the conductor of a direct distribution, and that of 25,000 francs for his cable, is therefore inaccurate for three reasons:—

1. Because we can distribute effectively with a potential higher than 100 volts.

2. Because the whole circuit does not require to be arranged for the sum total of the energy to be distributed.

3. Because in the system of MM. Gaulard and Gibbs, it is necessary to add to the cost of the cable that of the transformers and of their installation.

Since M. Gaulard has given us the opportunity to say all that we think concerning his system, we will take advantage of it to complete our observations and criticisms.

It would be a strange mistake to believe that the figure of 63 per cent. represents the real yield of the system of distribution by means of the apparatus of MM. Gaulard and Gibbs. This is the maximum yield which is reached only when all the lamps are lighted. If a certain number is extinguished the yield decreases, because the loss of the conductors remains constant, while the useful work is diminished. If half the lamps are extinguished, the yield falls to 50 per cent.

In the derivation system on the contrary, if only half the lamps are in action, the loss in the conductors diminishes and the yield improves.

Such are the direct consequences which result from these differences of action in the two systems. In an important distribution at the hours when the consumption is greatest, all the generators must act at once, and the two systems appear equivalent. But when the consumption is less, the derivation system permits a certain number of the generators to be stopped; whilst the system of Gaulard and Gibbs, with alternating currents, does not readily admit of this arrangement.

In fact we do not see how it would be possible to connect several distinct machines with alternating currents so as to make their phases agree and to add their effects. If MM. Gaulard and Gibbs have solved this problem they have not made the solution known. In any case the fact of a constant consumption by the conductors would considerably reduce the advantage which might be had from stopping a variable number of the machines, since, on their system the production varies much less quickly than the consumption.

There still remains the question of the leakages which has been systematically overlooked by the inventors and the expert. Dr. Hopkinson gives us, certainly, the conditions of action of the transformer placed at Edgeware Road, *i.e.*, if we are rightly informed, of the transformer placed nearest to the dynamo, but he does not tell us the conditions of action of that placed at the other extremity, 10 to 12 kilometres from the point of production.

What is the work really supplied to this transformer, what is the work available for the lamps, what is the yield? On all those questions the report is silent.

We still hold that the insulation of a conductor traversed by alternating currents of 2,000 volts cannot be so perfect that the losses on this score can be neglected. It results that the apparatus arranged at Aldgate and King's Cross cannot have received all the electric energy which the figures show, and that, consequently, they cannot have supplied to the lamps at these stations as much energy as at Edgeware Road, *i.e.*, as much as it was intended to allot them.

It is only by means of figures, resulting from direct measurements, that we can appreciate the importance of these losses, but we know from other sources that that cannot be neglected, as it is wished that we should suppose.

Lastly, even if the yield of the transformers of MM. Gaulard and Gibbs were complete we should still object to their use from a reason which, in our opinion, eclipses all the others.

The establishment of a distribution of electricity in great cities becomes daily more pressing, and shortly it will constitute a necessity of civilisation.

As we cannot admit of incessant alterations in the distribution any more than we can accept dangerous potentials, and as the distribution of electric energy must be of a nature to supply the greatest number of purposes, we consider that alternating currents should be strictly prohibited as means of distributing electric energy.

In short, parodying a celebrated dictum we may say that the distribution of electricity for domestic uses must be effected by continuous currents, or not at all.

This is why M. Gaulard, whose system is based upon alternating currents, is not of the same opinion as the undersigned.

E. HOSPITALIER.

PRITCHETT'S PATENT ELECTRIC FIRE ALARM.

THE object of this apparatus is to close an electric circuit when the temperature of a room rises above a certain point. Many devices have been invented for effecting this object, each of which have their own advantages or disadvantages. The invention of Mr. Pritchett enables the required result to be obtained in a very satisfactory manner. The apparatus consists (as shown by the figure) of a long glass vessel containing air; connected to this vessel there is a glass tube filled with mercury. The whole is mounted on a metal cradle, which turns on pivots. According to the position which the glass vessel and its adjuncts occupy in the cradle (this position being adjustable by means of a thumb-screw, seen at the upper part of the cradle), so will the same have a tendency to rock longitudinally over to one side or the other. Now if we suppose the position to be such that the right hand end of the glass vessel is depressed, and the left hand end raised, then if the vessel becomes subjected to an elevation of temperature, the air inside the same will become expanded, and the mercury column in the tube will be driven over to the left, and will rise in the turned-up end of the tube. This will cause the left hand branch of the glass vessel, and its attachments, to become increased in weight, whilst the right hand branch will become proportionally lighter; the consequence of this will be that the vessel and its cradle will cant over, and by falling on an electrical contact, will close a circuit and sound an alarm. It is obvious that the apparatus is equally well adapted for indicating a diminution as well as an increase of temperature, for if the electrical contact be placed under the right hand portion of the cradle, and the latter be adjusted so that in its normal position its left hand portion is depressed, then when the glass vessel becomes cooled, the air in it will con-

tract, and the mercury will fall in the turned-up portion of the tube before referred to, and will rise in the limb connected to the vessel, consequently the cradle and glass vessel will cant over in the reverse way to that which it did in the first case.

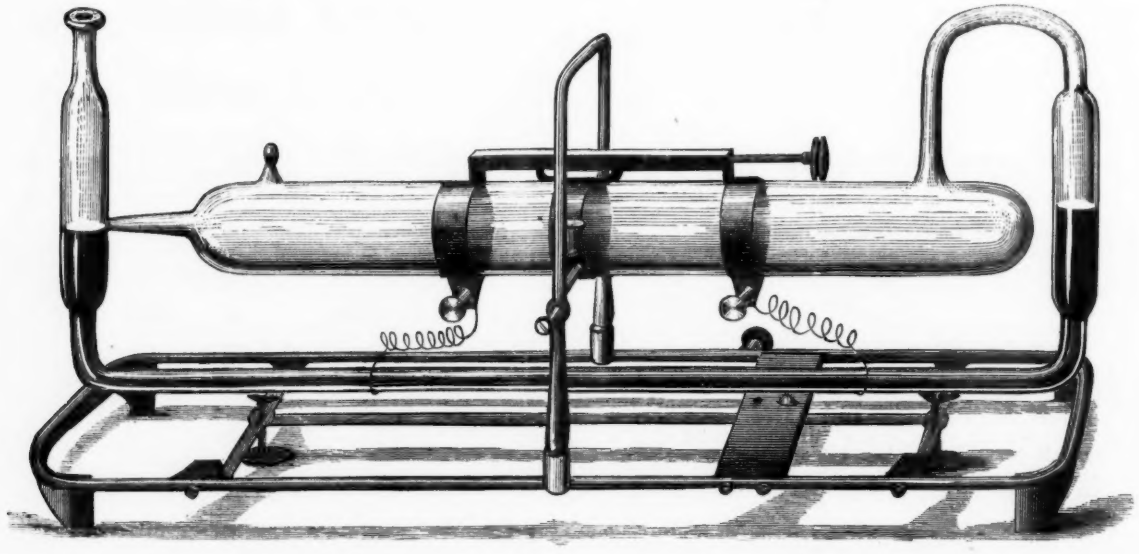
Owing to the surface which the glass vessel exposes, the air inside quickly responds to any external change of temperature, consequently the apparatus is very sensitive. Another important feature is the fact that the cradle and vessel in canting over acquires a certain momentum, and thus the contact made becomes very certain.

Mr. Pritchett proposes that his apparatus shall give external evidence outside the house by ringing a gong, and by dropping a semaphore arm released by an electromagnet. He also proposes (as has often been suggested) that a water supply shall be automatically turned on.

NOTES.

Electric Lighting.—The railway station at Darmstadt was illuminated with the electric light on Tuesday evening, when the Prince and Princess of Wales and their family arrived to attend the wedding of Prince Louis of Battenberg and Princess Victoria of Hesse. Electricity has also been largely utilised as an illuminating agency throughout the town during the wedding festivities.

In the last report of the Forth Bridge Company, Queensferry, it is stated that the electric light is now in regular operation on almost all parts of the works. It is to be used for lighting the caissons during the progress of sinking.



THE ELECTRICAL UNITS.

THE Congress on Electrical Units, now assembled in Paris, has decided unanimously that the length of a column of mercury of one square millimetre section, which shall represent the legal "ohm" shall be "106 centimetres." This makes the British Association unit now in use, ·9887 of the new ohm (which will probably be known as the "Congress" ohm). Thus, the legal ohm now is 1·0114 B.A. units. It is not the true ohm, or 10^9 C.G.S. units. This can scarcely be attained experimentally, but the number accepted is the mean of several observations made by the most eminent experimenters of the day.

DIFFERENT VALUES OF UNITS.

Year.	Authority.	Value of mercury unit. Ohms.	Value of B.A. unit. Ohms.	10^9 C. G. S. units in length of column of mercury at 0°C. 10 mm. section.
1865	British Association ...	0·9537	1·0000	104·83
1866	Joule	0·9411	0·9869	106·23
1873	Lorenz	0·9337	0·9791	107·10
1874	F. Kohlrausch ...	0·9442	0·9901	105·91
1877	H. F. Weber	0·9545	1·0009	104·76
,,	,, ...	0·9554	1·0018	104·67
1878	Rowland	0.9452	0·9911	105·79
1881	Rayleigh and Schuster	0·9434	0·9893	106·00
1882	Doru	0·9482	0·9943	105·46
,,	H. F. Weber	0·9419	0·9877	106·16
,,	Glazebrook and Sargant	0·9406	0·9863	106·29
,,	Rayleigh	0·9408	0·9865	106·27
1883	Rayleigh and Sidgwick	0·9410	0·9868	106·214
,,	Wild	0·94597	—	105·711
,,	,, ...	0.94627	0·9922	105·678
1884	Mascart	0·9405	0·9861	106·33
,,	Wiedemann	0·9417	0·9875	106·19
,,	Lorenz	0·9417	—	106·19
,,	Roite	—	—	105·90

The following suggestive advertisement appeared recently in the *Scotsman*. It will probably interest some of our readers and we therefore willingly give the Company the benefit of this extra publicity gratis :—

PAGET HIGGS, LIMITED, Electricians. In reply to numerous inquiries and applications for payment of Debts due by certain Electric Light Companies now extinct, PAGET HIGGS, LIMITED, would publicly intimate that they are in no way connected with any present or former Electric Light Company, and that no director or other party who held any interest in said Companies is upon their directorate.

The first successful installation of the Electric Light in Edinburgh may be seen in operation at any time during the day at their Temporary Offices with

Messrs. JOHN MITCHELL & SON,
106, Princes' Street, Edinburgh.

We understand that the Admiralty has entrusted to Messrs. Siemens Bros. the work of fitting electric light throughout the torpedo ram *Polyphemus* as well as supplying her with two powerful search lights. The system to be adopted is what is known as the one wire or earth circuit.

The Maxim Electric Light and Power Company, of Philadelphia, states the New York *Electrical Review*, has been awarded the contract for lighting the new Government buildings in that city, and the work of installing the plant is now in progress. The plant is to consist of 100 Weston arc lights, and 600 Maxim incandescent lights, which are supplied by eight Weston dynamos, driven by two Porter-Allen engines of 100 H.P. capacity each.

An exchange states that over 200 of the most prominent citizens of Portland, Maine, signed a petition to the mayor and aldermen of that city recently asking that the principal streets, squares, and promenades of the city be lighted with the electric light.

The *Economist* (N.Y.) states that a special committee was recently appointed by the Common Council of Grand Rapids, Mich., to investigate the various electric lighting systems in use. Eighty circulars were sent out, 54 of which were responded to with the desired information. Of this number 14 cities were lighted exclusively by electricity. The average price paid for lamps of 2,000 C.P. was found to be $217 per year, the lowest being Bay City, Mich., where they pay $100 each for lamps burning till midnight 250 nights during the year. The highest rate prevails at Mashville, Tenn., being $365 per year. Thirty-one other cities use electricity for street lighting. Of these 25 use the Brush, three the Thomson-Houston, one the Van Depoele, one the United States, and one the Fuller. The system used at Evansville, Ind., was recommended by the committee. Ten towers and 60 arches are used, with the Brush arc lamp. The towers are 150 feet high, with four lights of 4,000 C.P. on each. The arches are placed diagonally across the corners of two streets, so that the lamps placed upon them throw their rays in four different directions, to their full capacity, without obstruction. All of the cities visited had sent out committees of investigation, and all had reported in favour of electric illumination.

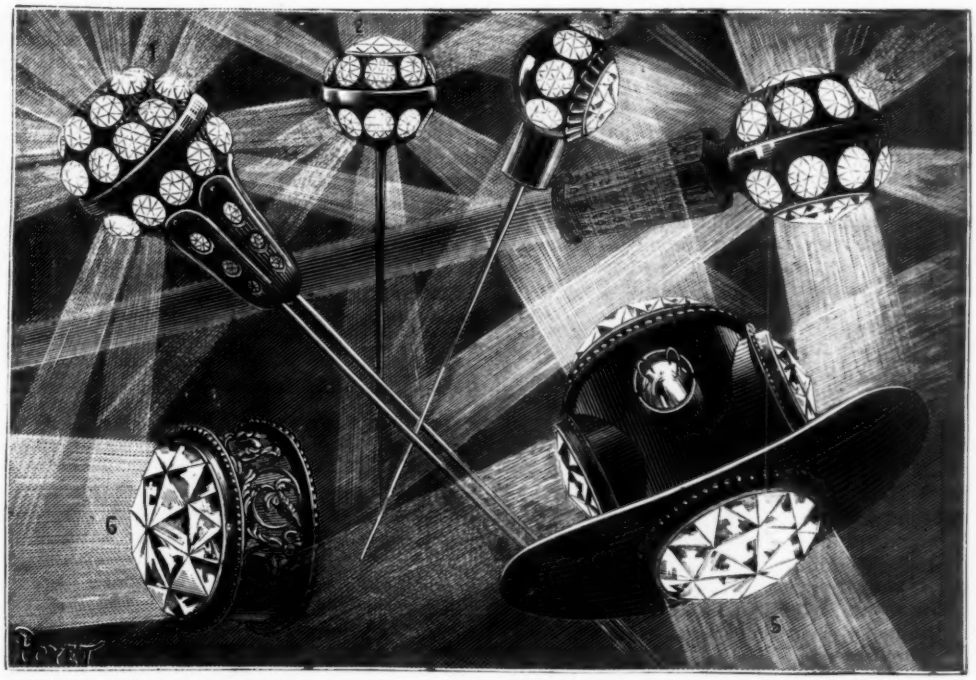
From the New York *Electrical World* we gather the following from a series of notes on the progress of the electric light in Philadelphia:—The Brush Electric Light station, at Philadelphia, is one of the finest to be seen anywhere on the Continent. The building is of one high story, 90 × 106 feet. The power is derived from a pair of Corliss engines capable of developing 500 H.P., and eight Porter-Allen 50 H.P. engines. These serve 19 dynamo machines, which will have a capacity, when the new armatures are put in, of about 1,000 lights. At present they supply a current to 725 lamps, of which 200 are day lights.

The Thomson-Houston Electric Light Company of Philadelphia control the territory of Pennsylvania, New Jersey, Delaware, and Maryland. They give attention principally to private plants. They have recently put in an installation of 50 lights for the Reading Railroad Company in Philadelphia, and another at Locust Point for the Baltimore and Ohio Company.

The Maxim Company, in Philadelphia, has a good share of electric lighting business, and the Excelsior Company's lights are seen on the streets though the circuits lie underground in some of the numerous conduits. The Edison light is also to be seen in some of the buildings in the city.

Dr. Gustavus Griffin, of the Phœnix Electrical Company, for Canada, says the *Montreal Witness*, recently offered to supply thirty arc lamps of two thousand candle-power each for the lighting of the streets of St. John's, Quebec, and to supply his company's system of incandescent lamps for stores and private use at five cents per light per night. After an exhibition of both arc and incandescent lights, arrangements were made with the authorities for lighting the streets with 2,000 incandescent lights, whilst more than 200 were signed for by merchants in Richelieu Street. This is the first contract for lighting a town in the Dominion exclusively by the electric light.

Electric Jewels at the Empire Theatre. — The accompanying illustration gives an idea of the effect of the Trouvé electric jewels, which are being used to add brilliancy to the grand spectacular arrangements at the



Empire Theatre, as described by us in our last issue. Each of 40 "amazons" in the electric ballet carries an aggregate of ten luminous points, arranged on helmet, spear, and shield.

The Opening of the Leeds Municipal Buildings.— Under the above heading one of our contemporaries, of course unintentionally, has allowed use to be made of its columns, which may do harm to those who have already been hardly dealt with in this same matter of the Leeds installation. Anyone unacquainted with the true state of the case would, on reading the paragraph to which we refer, be led to believe that Messrs. Paterson and Cooper had failed in their contract in point of time, and that another firm had specially put up the "good display" of the occasion, neither of which inferences are correct, as the following letter will show:

Town Hall, Leeds,
To PATERSON AND COOPER. *April 29th*, 1884.

Opening of the Leeds Municipal Buildings.

A paragraph in the *Electrician* of the 26th, calls for some explanation.

There was no electric lighting in the Municipal Buildings, and no contract had been entered into for them to supply the light in the Victoria Hall, where it was shown at the mayor's banquet.

Crompton and Co. had supplied this light at the recent musical festival—the fittings and engines had remained undisturbed, and were ready to work at almost a moment's notice, and at no material cost. It was a matter of good taste and good feeling towards the Mayor—Crompton and Co. are entitled to the credit of this—but no discredit rests on Paterson and Cooper, who had no connection at all with the Victoria Hall.

I am, respectfully,

(*Signed*) GEORGE TATHAM,

(Chairman of the Electric Lighting Committee, Leeds.)

A Submarine Electric Lamp.—A somewhat novel application of electric arc lighting was the subject of an experiment at Greenock last Monday night, under the direction of Mr. John Hayes, C.E., and partly as a result of his experiments in this direction, the *Tilly*, a steamer built for the Batavian fisheries by Messrs. Hanna, Donald and Wilson, has been fitted with a powerful arc lamp of 15,000-candle power, which may be lowered into the sea to a depth of ten fathoms or so, as required. The current for lighting this lamp is supplied by a Paterson and Cooper No. 4 dynamo, coupled direct to a Gwynne's vertical high-speed engine, the speed being 650 revolutions per minute. The novel feature of the installation is the lamp, which we understand is to be employed as a lure in the drift net fishing. The lamp is suspended over the vessel's side from a projecting davit, and is raised or lowered by a winch fixed to the bottom of the same. The conductors consist of very finely stranded copper cords, about half-an-inch in diameter, very flexible, and specially stranded for this work, which are enclosed in India rubber tubes. These conductors pass over pulleys on the end of the davit, the deck ends being coiled once round a drum which takes up the slack when the lamp is being raised. The lamp itself is enclosed in a flint glass cylinder, 9½ inches in diameter by 14½ inches long, and is protected by a copper grating made of ¼ inch round bars with two inch meshes. The whole of the electrical apparatus, as well as the lowering gear, has been supplied by Messrs. Paterson & Cooper. At the trial on Monday, the lamp was submerged in the Clyde for four hours while lighted, and we are told that the appearance presented at night on the surface of the water from the submerged lamp was very beautiful and striking. The trial, which gave to all concerned the highest satisfaction, was conducted by Mr. W. B. Esson, Messrs. Paterson and Cooper's engineer.

Buck and Hickman's Soldering Apparatus.—This apparatus is intended to supersede the use of the ordinary soldering copper bit and fire pot, for jointing telegraph wires. It consists of a small furnace formed by a spirit lamp with several wicks, enclosed in a perforated copper box; the flame plays beneath a shallow trough of copper, in which the solder is placed and in which the joint is dipped. The furnace will work well in windy and wet weather, and is quite adapted for the purpose for which it was designed.

Fast Travelling.—The Guion Company's steamer, *Oregon*, has made the shortest voyage on record across the Atlantic. She reached Sandy Hook in six days 10½ hours after her departure from Queenstown. This is 12 hours less than the fastest passage previously on record, which was made by the sister vessel, *Alaska*. The *Oregon* is fitted with Fox's patent corrugated furnaces, 72 in number, manufactured by the Leeds Forge Company, Limited. The sister ship, *Alaska*, known as the "greyhound of the Atlantic," is also fitted with 54 of these corrugated furnaces, which give a wonderfully increased raising and maintaining power of steam. In our issue of February 23rd, we drew attention to the manufactures of the Leeds company, whose works had just been illuminated by the Crompton system of electric lighting.

The Central News Company *v.* The Eastern Telegraph Company, The Exchange Telegraph Company, and Others.—This case, which has occupied Lord Coleridge and a special jury since Saturday last, is still proceeding. It relates to the alleged detention of a telegram from the Central News Company's correspondent announcing the fall of Tel-el-Kebir.

The American Institute of Electrical Engineers.—At a meeting recently held a committee of five was appointed to consider a scheme of organisation, with instructions to call a meeting to hear and act upon its report. The following gentlemen form the committee:—Messrs. W. A. Hovey, President Merchants' Electric Light Company, Boston; N. S. Keith, electrical engineer; George A. Hamilton, electrician W. U. Telegraph Company; Wm. H. Eckert, Gen. Supt. Met. Tel. and Tel. Co.; and Geo. L. Bettle, Western Electric Co.

The Society of Telegraph Engineers and Electricians.—The next meeting of the society will take place on the 8th inst., at 35, Great George Street, at 8 p.m., when the following paper will be read:—"On the Method of Eliminating the Effects of Polarisation and Earth Currents from Fault Tests," by Henry C. Mance, C.I.E., member, with some supplementary remarks and illustrative experiments by Latimer Clark, Past President.

Aurora Borealis.—Several very brilliant displays of aurora borealis were witnessed in the north and north-west of Scotland last week. Earth currents are said to have been observed on several wires.

Telegraphic Extension in Orkney.—A large and influential public meeting has been held at St. Margaret's Hope, Orkney, Mr. Laughton, of Blanster, presiding, when the amount required by the Post-office for the extension of the telegraph to that island, and also to the island of Burray and the fishing station at Holm on the mainland, was subscribed by merchants, curers, and fishermen. The Fishery Board, it was stated, has agreed to give two-thirds of the guarantee, and now that the sum is subscribed it is expected that the extension will be proceeded with at once.

Telephone Communication.—Mr. Gray asked the Postmaster General, in the House of Commons, on Friday, the 25th ult., if he could say before what day the estimates for the postal telegraph service would be brought forward; and whether he would have them submitted at such an hour as to afford opportunity for discussing the policy of his department towards the development of telephone communication. Mr. Courtney said the vote for the Postal Telegraph service could not be taken for a considerable time to come. It would therefore be premature to say at what hour it would come on. He would, however, consult the convenience of the hon. gentleman.

Time by Telephone.—An American paper states how a trans-Atlantic telephone company has enabled its subscribers to learn the time from the central office at any minute during the day by simply listening at their instruments. A clock apparatus has been connected with all the circuits, and this gives at the end of each minute the hour of the day and the number of minutes past the hour. The beats signifying this are distinctly audible, although not loud enough to interfere in any degree with conversation. If it happens to be 13 minutes past the hour, there is one beat, then a short pause, and then three more beats in quick succession. The attachment works successfully, and the only question about retaining it is the cost. It can be rendered useless on any given circuit by putting on an attachment called the confuser, which mixes up the beats so that no one can tell what they mean.

Destruction of Telegraph Wire.—The Indians in Alaska are said to have used, in making salmon nets, the bulk of 900 miles of telegraph wire, which was laid by the Overland Telegraph Company many years ago, at a cost of $3,000,000.

United States Government Telegraph Schemes.—"The Senate Committee on Post Offices and Post Roads," says the New York *Electrical Review*, "is making slow progress in its preparation of a Bill to establish a postal telegraph system, and it will be some time before the proposed measure will be reported. There are some differences of opinion among the members of the committee as to how the system should be created. Some, including Chairman Hill, are in favour of having the lines built or purchased by the Government without regard to existing private lines. Others believe that it would be well for the Government to enter into contracts with existing telegraph companies as proposed before the committee by the Postal Telegraph Company. The result will probably be the preparation of yet another Bill establishing a postal telegraph system and providing that bids for the work shall be received from private corporations. The Bill will also provide that in case it is not found practicable or advisable to accept any of the bids, the Government shall go ahead and build its own lines. In recommending such a Bill it is expected that all the members of the committee will unite.

Personal.—Mr. Nigel M. Arnott, late of the Metropolitan Brush Electric Light and Power Company, Limited, has received the appointment of electrician in London to the Australasian Electric Light, Power, and Storage Company, Limited.

The Slater Lewis Insulator.—Several American journals have recently published notices of this insulator in which they advocate its introduction into the United States. We shall be glad to hear of its success on the other side of the Atlantic.

Electric Railway Bill.—The London Central Electric Railway Bill was opened on Tuesday before a Select Committee of the House of Commons, presided over by Sir Joseph Bailey. It is a scheme for providing direct communication between the West End and the City, and it is to join at Trafalgar Square an electric line authorised in 1882, and by this means Waterloo Station will be reached. Starting from Trafalgar Square and Regent Circus, it goes to Dudley Street, St. Giles's, from which point a line is to be carried by George Street, Bloomsbury Street, New Oxford Street, Snow Hill, Holborn Viaduct, and Newgate Street, to St. Martin's-le-Grand. Mr. Bidder, Q.C., and Mr. Moulton appeared for the promoters; and Mr. Pope, Q.C., Mr. O'Harland, and Mr. Cripps, for the Metropolitan Board of Works, who oppose on the ground that it interferes with their easement. Mr. Bidder, in opening the case, said it was proposed to work this line by electricity, and he might say that electric railways were working very successfully in Berlin, Paris, and Frankfort, and there were six miles at Portrush, in Ireland. The estimated cost of the line was £395,000. The share capital was £500,000, with one-third borrowing power. The line was to be constructed in a tunnel throughout, and there would not be any of the noxious smoke or steam such as they had on the District Railway. It would be worked by stationary engines, and there would be no difficulty in getting 30 trains per hour in each direction. The speed would be about 10 or 12 miles per hour, and the fares would be exceedingly low. Having called Mr. Law, C.E., and Mr. Siemens (nephew of Sir William Siemens), as witnesses, the committee adjourned.

The Committee resumed its consideration of the Bill on Wednesday. Mr. Robert Vigers, called for the promoters, said he was a surveyor and valuer, and, having made the necessary examination, he was of opinion that the estimate for the undertaking was quite sufficient. The railway, if constructed, would develop a large traffic, and be of great public service and accomodation. This concluded the case for the promoters, and Mr. O'Hara, addressing the Committee on behalf of the petitioners against the Bill, said they did not oppose the passing of a Bill for a line from Waterloo to Charing Cross—let that experiment be made; but what they said was that they had no right, until that experiment were proved to be a success, to allow this company to utilise surplus land, purchased at considerable expense by the Metropolitan Board of Works, and of which it was their bounden duty, as the trustees of the ratepayers, to make the best use they could. Several witnesses having been examined for the petitioners, the Committee decided the preamble had not been proved.

Edison Interviewed.—Mr. Edison was recently "interviewed" by the representative of an American newspaper, in which was subsequently published his opinions on matters electrical. Mr. Edison speaks very hopefully of the prospects of his incandescent light, which, he says, is now in full operation in 13 cities in the United States, while some 70 or 80 plans are in hand for other cities. In New York the full capacity of the stations down town is sold, there are 147 applications that cannot be met at present, and arrangements are nearly completed for the two big uptown stations. As for his electric locomotive, the time for that is coming, he says, but he doubts whether that or any other will be introduced on the great arterial roads. But the chief point of interest in the conversation is his remark: "We want to get electricity from coal direct without the intervention of boiler and engine. A good many people are at work on it. We don't see our way at all to it, but I will say it is surely possible. Zinc and other metals we can get into electricity at once, but the trouble is to do that with coal and carbon. If we could, we would get six horse-power from one pound of coal, while with the boiler and steam engine we get only one horse-power from three pounds of coal."

City and Guilds of London Institute.—At the meeting of the executive committee of this institute, held on Monday, the following appointments were made at the central institution, Exhibition Road: To the Professorship of Chemistry, Henry Armstrong, Ph. D., F.R.S., of the Technical College, Finsbury; to the Professorship of Engineering, W. C. Unwin, B.Sc., of the Royal Engineering College, Cooper's Hill; to the Professorship of Mechanics and Mathematics, Olaus Henrici, Ph. D., F.R.S., of University College, London; to the Professorship of Physics, Oliver Lodge, D.Sc., of University College, Liverpool.

Kinks in Submarine Cables.—A correspondent writes to an exchange as follows:—In the issue of April 12th, page 123, I find "Kinks in Submarine Cables, etc." It is really amusing to note that the expedient adopted by Messrs. Trott & Hamilton is to make each alternate layer of sheathing cross each other. This method of placing the hempen bedding around a cable previous to its being armoured with wires, was adopted by Mr. W. W. Marks, Superintendent of the Bishop Gutta Percha Works of New York City, in the year 1864.

A House in which Morse Lived.—An American contemporary remarks that the house on the Hudson, near Poughkeepsie, once occupied by the late Prof. S. F. B. Morse, is offered for sale. This house stands on a bluff overlooking the river, and is said to be one of the most desirable country seats along the Hudson.

The Drawbaugh Claims.—The last of the sur-rebuttal evidence in the Bell *v.* Drawbaugh case, states the New York *Electrical World*, has been given in at Harrisburg, Pa., during the last few days. It is not expected that the case will come to trial in June or July. The Drawbaugh representatives consider that the last evidence materially strengthens their testimony already obtained, and makes them impregnable.

Electric Lighting at the Health Exhibition.—The department of the new exhibition at South Kensington, devoted to electric light machinery, is now a

scene of great activity, engines, dynamos, shafting and pullies being rapidly built into position; and all over the building, men are occupied running wires and fixing up the lamps and fittings. Altogether there will be about 5,000 incandescent and 350 arc lamps to feed, for which there will be required 62 dynamos, the power for the whole being supplied, as at the Fisheries, by engines made for the special purpose by Messrs. Davey, Paxman & Co., of Colchester. The entrance vestibule, the art gallery and the dining-rooms, are to be lit by the Edison-Swan Company's incandescent lamps, the south gallery and the Prince of Wales's pavilion also by Swan lamps, the total of 1,280 supplied by Messrs. Siemens Bros. The Hammond Company light the aquarium, west arcade, and west dining-room, with 1,000 incandescent lamps fed by two Ferranti dynamos, and the west and east quadrant, east arcade, and third-class dining-room, with 40 arc lamps from a Brush dynamo. The south central gallery, central avenue, and parts of the central galleries, are taken in hand by the Jablochkoff Company, to be fitted with 80 arc lamps, receiving their current from four alternating machines. Messrs. Oppermann Bros. light the water pavilion with 300 incandescent lamps. The other companies and firms engaged in the work of lighting the buildings are—the Anglo-American Brush Company, the British E. L. Company, the Gülcher E. L. Company, the Gerard E. L. Company, the Pilsen-Joel E. L. Company, Messrs. Paterson and Cooper, Messrs. Varley, Messrs. Clark & Bowman, Messrs. Elphinstone and Vincent, Mr. Mackie, Mr. H. Edmunds, Mr. Willard, Mr. Tayler Smith, Mr. Sennett, and probably others of whom we have received no information.

Electrical Exhibits at the Health Exhibition.—At present we have not heard of any other intended exhibition of articles of an electrical nature, with the exception of the Griscom motor, which will be shown working sewing machines, lathes, and so on.

Space.	Exhibitors.	System of Machine.		System of Lamp.	
		Continuous.	Alternating.	Arc.	Incandescent.
1 Entrance vestibue	Swan-Edison	10	..	..	..
2 Arts gallery					
3 Dining-rooms		..	..	..	1000
4 Cheap Do.					
5 South gallery	Siemens-Swan	2	2	..	1080
6 Dairies	Gülcher-Crookes	3	..	..	350
7 South annexe					
8 Small corridor	Varley	1	..	20	..
9 City Supt. room	Edison-Swan	..	..	..	..
10 East corridor	Paterson & Cooper	1	..	8	..
11 West Do.	Clark & Bowman	1	..	9	..
12 El. machinery	British E. L. Co.	2	..	8	..
13 Old London	Elphinstone-Vincent	1 E. V.	..	5	350
13 Do.	Mackie	2Gramme	..	..	300
14 Water pavilion	Oppermann, Crompton	1	1	1	200
15 P. of W. pavilion	Siemens-Swan	..	1	..	..
16 So. central gallery	Jablochkoff	..	4	80	..
16 Cent. avenue					
16 Part of E. c. gally.					
16 ,, W. c. gally.					
17 W. centl. gally.	British E. L. Co.	4	..	10	..
18 E. centl. gally.	Elphinstone & Vincent & Sennett	1	..	10	..
19 E. & W. annexe	A. Am. Brush	2	2	16	..
20 Aquarium	Hammond E. L. Co.	1	1	..	1000
20 West arcade	Ferranti				
20 West dining-room					
21 W. & E. quadrant	Hammond, Brush	1	..	40	..
21 East arcade					
21 3rd cls. dining-rm.					
22 W. gallery	Pilsen E. L. Co.	2	..	..	..
23 E. gallery	Gülcher	2	..	40	..
24 Central gallery	H. Edmunds	1	..	40	..
25 Refreshment bar	Willard	..	..	25	40
26 Cottage ornce	Tayler Smith	2	1	..	40
27 Vegetar. buffet	Anglo A. Co.	2	1	..	80
28 Central fountain	Sir F. Bolton, Sennett	1	..	8	..
29 Cascades?		..	..	..	..
30 Jury-room	Mackie	1	..	..	..
31 Indian tea-room	Hammond	1	1	..	..
32 Queen's Gate entrnce.	Oppermann, Fox	..	..	1	..
33 Mast light	H. Edmunds	1	..	6	..
34 Smoking gallery	H. Edmunds	1	..	..	250
35 Conservatory	Siemens	1	..	4	..
36 Doulton pavilion	Gerard, E. L. Co.	1	..	..	20

Telephony in Melbourne, Australia.—The directors of the telephone company at Melbourne, Victoria, have determined to erect new premises for their central office contiguous to Queen Street. The apparatus will, when complete, give connections for 3,000 subscribers, and it is promised that the whole equipment "will make the exchange system one of the finest in the world."

The Pyramid Electric Company, Limited.—This company having passed resolutions for a voluntary winding-up and appointing liquidators, a petition was presented by the company and the liquidators, before Vice-Chancellor Bacon, on Saturday the 26th ult., asking that the voluntary winding-up might be continued under the supervision of the Court. Mr. Swinfen-Eady appeared in support of the petition. The Vice-Chancellor made the order, but directed the liquidators to be struck out as petitioners, and the petition to be served upon them.

International Patents Convention.—The *Daily News* correspondent telegraphed from Paris on the 25th ult., that the British Chamber of Commerce had received a letter from the Foreign Office officially stating that England adheres to the International Patents Convention, and that her Majesty's Government understands that ratifications will be exchanged on the 1st May. This convention, a translation of which was published in the February number of the *Anglo-French Mercantile Review*, comes into operation a month after the ratifications.

Telegraphy in Australia.—A movement is on foot in Victoria for securing a reduction in the price of ten-word telegrams from 1s. to 6d.

The Ballaarat School of Mines.—Messrs. Henry Sutton and Walter Campbell, the lecturers on electricity and magnetism, and telegraphy in this institute, give the following reports for the year 1883:—*Electricity and Magnetism*:—"I have the honour to report that the classes under my charge have made satisfactory progress; some little difficulty is of course experienced on the formation of classes, in which the study of applied science is the main feature; it is therefore gratifying to know that in the subjects of electricity and magnetism, sufficient advancement is shown to well ground the belief that some of the students, by perseverance, are capable of attaining to a position of honourable distinction. The apparatus under the control of the senior class is in a thorough state of efficiency. Owing to the very judicious selections of the boys by the various head masters, a State school class has been formed, which for intelligence, order, and attention, has proved very satisfactory." *Telegraphy.*—The following is a report *re* telegraphy class:—"The attendance of this class during the past year has been exceptionally good, 37 being the number on the roll for the January term, 37 for April term, 56 for July, and 38 for the September term, or an average number of 42. The number enrolled for July term was the largest ever seen in the school, and necessitated the division of the class, one portion being placed under the tuition of Mr. Burbidge during the day, the whole class assembling as usual during the evening. At the examination held in March, 8 students passed, 3 obtained 'credits,' and at the September examination 20 passed, 5 with credit."

Lighthouse Illuminants.—We have already notified that experiments are being made as to the respective properties of oil, gas, and electricity, as illuminants for lighthouses, the place selected for carrying out the tests being the South Foreland. We observe in the *Dover and County Chronicle*, of the 12th ult., that three temporary wooden experimental towers have been erected in a straight line landward from the high lighthouse, the distance between the latter and the first tower being 245 feet, and each tower being 180 feet apart. The height of the towers is about 15 feet below that of the high lighthouse, which is 356 feet above the sea level, and it is anticipated that the full strength of the experimental lights will be visible to the northward of South Foreland within the bearing from ship of W. by S. into the land, and to the southward within the bearing of N.E. by N. in towards the land. In the first of these temporary structures electric lights will be installed, in the second gas lights, and in the third oil lights. The electric lights will be produced by

three of De Meriten's magneto-electric machines and lamps, each machine arranged for working at 1-5th, 2-5ths, 3-5ths, and at full power; the estimated intensity of the light from each machine at those powers being 6,000, 12,000, 18,000, and 30,000 candles respectively. These machines, which can be worked singly or collectively, as occasion demands, will be driven by the steam engines at present employed in producing the permanent electric lights at the South Foreland Lighthouse. The gas lights, for which gasworks have been erected on the site, will be produced on the system (and under the personal supervision) of Mr. J. R. Wigham, of Dublin, which system has been extensively adopted for lighthouses on the Irish coast, and has been employed for many years past at one lighthouse—that of Haisborough, in Norfolk, on the English coast. This system, which Professor Tyndall has, from its first introduction, enthusiastically championed, consists in the flames of one, two, three, and four large burners being introduced over each other in the axis of an optical apparatus, the heights being designated uniform, biform, triform, quadriform, according to the power invoked, which the light keeper varies at will to suit the varying conditions of the atmosphere. The oil lights will be produced by Trinity House six and seven concentric burners, containing paraffin. Not only will the gas lights be arranged one over the other as already described, but three electric and three oil lamps will be similarly placed and simultaneously lighted in their respective towers. For the purpose of witnessing the effects of the several lights, a route has been set out and staked at every 100 feet, for a distance of 2½ miles landward of the South Foreland, in the direction of Deal. At the limit of the first half mile a temporary hut is erected for affording more elaborate observation, and for recording the photometric powers of the luminaries; at the limit of $1\frac{1}{16}$ mile a similar hut is placed, and at the extreme limit of 2½ miles a third. Observations will also be made from coastguard stations along the shores, from Ramsgate and other contiguous places, and from various points at sea, notably from the Hull and Varne light-vessels, the former situated 8½ miles in a north-easterly, and the latter 12½ miles in a south-westerly direction from the South Foreland. A few remarks on the salient points for consideration in connection with this subject, says the Dover journal, may not be here out of place. Respecting minimum cost and maximum intensity, there is no doubt, judging from existing data, as to the relative order of merit. The oil lights will prove the cheapest, and the electric lights the most penetrative under ordinary conditions of the atmosphere. These results are, it is understood, foregone conclusions. The paramount questions for determination are:—(1) Does the gas system by virtue of the greater intensity of light which it affords the mariner as compared with the oil light, and because of what Professor Tyndall calls its "wonderful flexibility," confer on it such a superiority over oil as to justify its much greater comparative cost? and (2) if so, then, as the matter of cost is to be considered a subordinate point as between oil and gas, should (or should not) the same process of reasoning be extended to gas and electricity, and the greater penetrative power of the latter (in at least normal weather) as compared with the former be equally held to justify its increased cost? (3) Although the electric light is under ordinary conditions of atmosphere the most powerful of the three luminaries, is its penetrating qualities during fog superior to gas? The advocates of the latter luminary contend that, what its opponents regard as a serious defect, is really one of its conspicuous merits—viz., its lack of what is called "focal compactness." Much of the light of Mr. Wigham's large gas burners is, as he admits, ex-focal; but he contends that the glare of this ex-focal light upon a fog is of greater utility to the mariner than if the whole of it were as perfectly utilised by the optical apparatus, as is the small electric spark. The final settlement of this question is one of the most important issues which these experiments should decide.

Early Ideas of the Telephone.—Great interest always attaches, says the New York *Electrical World*, to the process of tracing back to their origin the conception of new ideas and invention. We give below one of the latest "treasure trove" items in connection with the telephone:—In a fairy tale, written by the Brothers Mayhew, published in London in 1847, and called "The Good Genius that turned everything into Gold," occurs this passage:

"Let their voices be heard
At a distance no voice could reach!
And swiftly as thought
Let the words be brought
And the lightning endowed with speech!

"As the Queen looked up she saw suspended above her a series of long metallic threads, which ran through the air till they were lost in the distance. 'You wished to speak with your husband,' said the little Bee. 'I shall be pleased to convey any message you please to him; and, as I knew your business was immediate and important, I thought the best plan would be to send it by lightning for you, so that you might receive an answer by the next flash. What shall I say to him for you?' 'Ask him if he needs a fairy dress?' eagerly cried the princess. 'It is done,' said the Bee. And instantly the words went tearing through the atmosphere on the wings of the lightning messenger. And swift as a sunbeam the answer returned."

Expediting Legislation by Electricity.—The Washington (U.S.A.) *Post* gives the following description of the manner in which electricity is made to expedite the taking of votes:—In the room of the House Committee on Education is exhibited the electric device for enabling a yea and nay vote to be taken in the House instantaneously, instead of consuming nearly an hour, as at present. Each member would have on his desk a small lever, which, when turned to the right, votes "yes" and the left "no." The "yeas" and "nays" are taken at the same time. The votes are automatically counted, and the result placed before the presiding officer. The name of each member voting, and his State, and also the word "yea" and "nay" is at the same time printed on a record sheet on the clerk's desk, and exhibited on an annunciator in full view of everyone. At the close of each day's proceedings the record sheet, showing in consecutive order every vote taken, is removed for the use of the printer. There is no possibility of any member voting twice on the same call or motion, as in the act of voting he breaks his circuit, which is not again closed until the vote is announced. In making a call of the roll the record sheet will contain the names of the members present, and the number present will be shown on the presiding officer's desk. In addition to the voting apparatus, each member would have upon his desk an electric press-knob, operating on an annunciator, for summoning pages.

NEW COMPANY REGISTERED.

Carbon Cutting Company, Limited.—Capital £500 in £10 shares. Registered office, 108, Bishopsgate Street, E.C. Objects:—To acquire and work the invention of Mr. Thomas James Howell, relating to machinery and apparatus for cutting carbon and other substances. Signatories (with one share each)—W. H. Scott and J. H. Wyatt, 108, Bishopsgate Street; G. J. Scott, 14, Queen Victoria Street; E. H. Symon, 120, Highbury Hill; J. Fisher, 93, Mildmay Road, N.; N. Cook, 144, Fenchurch Street; H. A. Morris, 133, Marylebone Road. Registered 26th ult., by Scott and Wyatt, 108, Bishopsgate Street.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Atlas Electric Appliances Company, Limited.—The statutory return of this company, made up to the 14th ult., was filed on the 24th ult. The nominal capital is

£2,000 in £1 shares; but the only shares at present taken up are the seven subscribed for by the signatories to the memorandum and articles of association. Registered offices, 206, St. George's Street, E.

London and Derby Electric Wire Company, Limited.—The annual return of this company, made up to the 3rd ult., was filed on the 24th ult. The nominal capital is £5,000 in £1 shares. 800 shares have been taken, and upon 260 of these the full amount has been called up, and 10s. per share upon the remaining 540. The total calls paid amount to £530. Registered office, 122, Fore Street, E.C.

DISSOLUTION OF PARTNERSHIP.

Clegg, William James, and **Shaw, John,** insulated wire manufacturers, Manchester.

Brown, Frederick, and **Dewsbury, Alfred,** makers and dealers of and in electrical apparatus, appliances and fittings, and electrical agents, trading under the style of the Walsall Electrical Company, the Bridge, Walsall.

CITY NOTES, REPORTS, MEETINGS, &c.

Oriental Telephone Company, Limited.

AT the fourth ordinary annual general meeting of this company, held at the Cannon Street Hotel on Wednesday, Mr. John Pender presided, and there was a fair attendance of shareholders. The directors' report submitted to the meeting was published in our last issue.

The Secretary, Mr. W. G. Hall, having read the notice convening the meeting, and the minutes of the previous meeting, the latter being confirmed,

The Chairman said although he could not put before them a very brilliant statement, still he could with some confidence say that their affairs were not in an unsatisfactory condition. He could speak with a good deal of experience of electricity generally, and he knew how slow telegraphy was, but at the same time he knew that when it got a firm grip of the community where it was established, it made good and certain progress; this also held good in regard to telephony, he felt certain, and in regard to electric lighting as well. This company had not been in existence more than two years, and those who attended the first meeting would remember that he drew attention to the fact that he believed telephony would be of more or less assistance to telegraphy; it was for that reason that he consented to go out of his usual way to take an interest in the telephonic system. So far as he could see now, he believed that the telephone in such countries as India, Egypt, China, and such other places as they had established their system in, was used almost specially for business purposes, and was thereby a great aid to telegraphy, and as it grew it would continue to be so in a still greater degree. But he found in India in regard to the telephone very much the same thing as in the earlier days of telegraphy: the minds of the Eastern people did not move as quickly as those in the Western world, and consequently the progress was slower. But the telephone, even in England, had not grown so rapidly as some of the most sanguine believers in it thought it would do. In regard to their business at Alexandria, he believed that had it not been for the state of affairs existing there since the creation of this company, Alexandria would by this time have been almost of itself sufficient to pay interest upon the capital invested in the company; but unfortunately the state of affairs there precluded that business progress which used to exist in former days. He hoped the time was coming when it would be at an end; but even in the present state of things it was remarkable how much the telephone was used both at Alexandria and at Cairo. In regard to India, there could be no doubt whatever that Calcutta and Bombay would, before a very long period of time, come under the influence of telephony. The advantages in those places were so marked that it was impossible that the telephone could exist there without being generally adopted by the European mercantile element, and he believed also that as soon as the native population began to use it the development would be very rapid indeed. Madras was always a slower place, but there were evidences of life there. With the exception, perhaps, of China, there was not one point where they had established themselves that did not show some progress. They had a good property, which required careful attention and economical management, and with this he had no doubt whatever but that the result would be a most satisfactory one; but Rome was not built in a day, and telephonic communication was a thing they had to teach; progress, though slow, seemed to him certain, and they could not expect a new invention to jump at once to a large and productive business. They had established a very successful system in the Hawaiian Islands, but they found they were in the hands of those they could not properly trust; in fact, the prosperity of the thing created almost its own destruction as far as the company was concerned, and they had pretty well cleared out. Mr. Carnegie, one of the directors, had recently visited India, and he entirely conformed to the opinion he (the chairman) had already given in regard to Calcutta and Bombay. What he desired to strongly impress upon the shareholders was that, theirs being a new enterprise, they should not be in too great a hurry to expect large harvests. They would see by the accounts that the board had acted upon the advice of their accountants, and in the same way as other telephone companies had done, by distributing as dividend the money acquired by the sale of patent rights. Mr. Pender then explained his reasons for desiring to retire from the board. He had always advocated that the number of directors should be reduced, and the time having arrived for the ballot to be taken as to who should retire, it so happened that Sir Alexander Armstrong, his (the chairman's) son, and himself were balloted out. When he first joined the company, he thought he might be of some assistance in establishing the business in India and other places with which he was to some extent connected; in this he had succeeded, and now he felt it was more personal attention to details than to broad policy that was needed, and as his time was greatly taken up in other ways, he felt he ought to put into practice that which he had preached, and not offer himself for re-election. He felt the greatest confidence in leaving the management in the hands of his late colleagues, who were all capable men. Colonel Gouraud probably knew as much as any man about the working of the telephonic system; and Mr. Hall, the secretary, had given his time, attention, and thought to the matter in a degree that was greatly appreciated by the directors. He (Mr. Pender) was willing, if some influential shareholders would consent to act with him, to continue his services to the company by giving what assistance and advice he could, without any remuneration, as a member of a consultative committee. He should be happy to give them the benefit of his experience in that way as long as the company continued. He concluded by moving:—"That the accounts made up to the 31st December, 1883, and showing the transfer of the sum of £10,000 to profit and loss account from suspense profit account on conversion of the Egyptian exchanges, together with the directors' report now submitted to the meeting, be approved and adopted, and that the dividend recommended by the directors for the year ending 31st December, 1883, of 5 per cent. per annum, free of income tax, be and is hereby declared on the ordinary shares of the company, other than the vendors' shares."

Colonel Gouraud (deputy chairman), in seconding the motion, said the board had given the matter of the dividend, perhaps, unusually anxious consideration, and it would be observed that if they had not taken from the realisation of the company's interests with respect to the Egyptian Company, the net results of the year would not have shown a balance from which to pay a dividend, owing chiefly to the fact that they wrote off against the profit and loss of the year the amount they were called upon to pay under their guarantee in connection with the Bombay shares. If his own personal convenience had been consulted, he would have preferred that no dividend should be paid; but the shareholders were apt to grumble if they thought there was anything kept back out of which a dividend might be paid, and so it was unanimously agreed to pay it. Having spoken in terms of regret of the retirement of Mr. Pender, and testified to the valuable assistance that gentleman had rendered in his capacity as chairman, Colonel Gouraud concluded by seconding the resolution.

The Chairman, replying to questions by Mr. Wainwright, said he had stated that there was a steady progress going on, and particularly was this the case in Egypt. In Alexandria and Cairo the increase during the year had been 187 subscribers to the exchange and private lines; and the gross income amounted to £6,600. With regard to Egypt, he had no hesitation in saying that if the policy he held were carried out, this company would take a position there which would be such that that £6,600 would be doubled in a short time. As long as there was no government, as long as England was supposed to rule in Egypt and did not rule, so long could there be neither commercial nor agricultural progress. But the present state of things could not continue long; he thought the spirit of the nation would rise against its continuance, and the moment a new order of government was established their prospects would be opened up in a greatly extended degree. With regard to India, he was satisfied that that of all countries was the place where the application of electricity would be so developed as to meet their most sanguine anticipations.

The motion for the adoption of the report was then put and carried.

A letter was read from Mr. Ackers, one of the largest shareholders, who had been written to on the subject, in which he declined to become a director, but consented to act with Mr. Pender and others as a consultative committee. Mr. Ackers, who was present at the meeting, also personally expressed his willingness to act in that capacity if the shareholders desired that he should do so.

Mr. James Pender declined to offer himself for re-election, and no one nominating Sir Alexander Armstrong, all three of the retiring directors severed their connection with the board, and no one was appointed to replace them.

Mr. Forbes moved, and Mr. Roberts seconded, the re-election of Messrs. Deloitte, Devers and Griffiths, as auditors, and the motion was carried; after which, with a hearty vote of thanks to Mr. Pender and the other directors, the proceedings terminated.

Provincial Brush Electric Light and Power Company, Limited.

AT the City Terminus Hotel on Tuesday Sir Michael Kennedy presided over an extraordinary general meeting of this company, held for the purpose of reducing the capital.

The Secretary, Mr. Alfred Jermyn, having read the notice convening the meeting,

The Chairman said: We have called this meeting in answer to what we believe to be a very general desire to reduce the capital of this company, and thereby to still further limit the liability upon the shares, and the resolution we shall have to consider provides for doing this to the greatest extent practicable, having regard to the engagements and liabilities of the company which in any case would have to be met. We must not disguise from ourselves that, by adopting this measure, we must submit to some sacrifices. It will curtail our opportunities of dealing with any business that might be offered to us, and it will entail the entire loss of our provisional orders, which have been obtained at the cost of some trouble and not a little expense. The prospects of electric lighting, it must be admitted, are not so bright as we may have hoped and expected at one time, but we feel confident a turn will take place before very long, and hope this measure will not prevent us taking advantage of that turn when it does occur. We very recently made a similar arrangement in the South Eastern Company, and the committee of shareholders acting with us at that time, expressed their opinion that the measure of reduction would not hamper us in raising fresh capital should we require to do so, and I hope it will also be the case with regard to this company. Our company, therefore, is to lie by for a time, and in the meanwhile to reduce our outgoings to the lowest possible limit. In this view we have made arrangements for carrying out large reductions both of establishment and salaries; we propose to move into cheaper offices, and the directors, until dividend has been earned, will not take any further remuneration. The ultimate result of these reductions will be, that our working expenses will be brought down to about £700 per annum. I beg to move, "That the subscribed capital be reduced from £99,205 to £54,562 15s., and that such reduction be effected by reducing, by £2 5s. per share, the liability upon each of the 19,841 of £5 each now in issue."

Mr. Fry seconded, and said that although in accepting the views which had been expressed by a considerable number of the shareholders the board virtually imposed upon itself trammels, the shareholders must only expect them in future to do that which the limited amount of capital would allow them to do.

The resolution was carried unanimously.

A Shareholder asked if it was intended to call up the 5s. remaining unpaid.

The Chairman replied that it would not immediately be called up, but eventually it would have to be. Replying to another shareholder, he stated that the balance at the banker's was £3,577 6s. 1d., whilst there was an uncollected call of £790 15s.

Mr. Offor, the manager of the company, said it was satisfactory to be able to mention to the shareholders that the B.T.K. system, which was that which they had adopted—a system of a house-to-house supply of electricity by means of storage batteries—had already been carried out during the last week, after long delays in getting the apparatus made, at the residence of Mr. Alfred Rothschild. The installation there was practically the same as that being carried out for house-to-house lighting at Colchester, and consequently they had the satisfaction of knowing that their system was a practicable one, for the result of the experiment at Mr. Rothschild's was thoroughly successful, and the attempt at Colchester would probably be equally so. On the following day (Wednesday) the trial lighting at Colchester would be made. Those who were practically acquainted with the subject would understand that, in carrying out an entirely new system which had never been attempted before in any part of the world, they would almost as a matter of course, have to meet with delays, for machinery had to be made to carry out the designs. The delay might seem long to them, but in the history of the enterprise they were engaged in, it would be looked back upon as very short. Within 18 months they had a system by which, on the same lines as gas was supplied, simply by taking wires into a man's house, he could receive a supply of electricity without being dependent upon machinery, and this had been done after according with very harsh rules laid down by the Board of Trade. The experiment at Colchester consisted of a supply of electricity from a central station to storage stations in different parts of the districts, from which groups of houses were supplied. The batteries were charged in series by means of that excellent Brush high tension machine, and the delivery was made by means of their rocking switch, and a low tension current; there were no high tension currents in connection with the houses. After the result of the experiment was made known, he had no hesitation in saying, judging from the communications he had had with those connected with the industry, that their only difficulty would be to produce the apparatus and to find men to fix it; as to the demand, there was no question about that. As they were aware, provisional orders were not only granted to companies such as theirs, but also in large numbers to local authorities, who did not suffer from the question of capital as the private companies were likely to do. Shareholders had been impatient, and naturally so, at the want of result within the time the company had been formed, and consequently were desirous, from want of confidence in the whole industry, of reducing their liability. In the act they had just committed they had, to a certain extent, injured the industry, because the public formed its opinions on the prospects of electric lighting by the actions of the shareholders, and were distrustful when they saw capital being reduced. The company was in communication with some of the local authorities who had obtained provisional orders, and in some cases they were only waiting for the results at Colchester before entering into business with the company for carrying out Schedule A of their orders. One local authority, a sub-committee from which he had seen a few days before, which did not represent a large township, stated that difficulties had been arrived at with the gas company, and a provisional order for electric lighting obtained; arrangements had already been made for borrowing £40,000, and the total requirements for the district to be lit would be 60,000 lamps. This would give them some idea of the gigantic nature of the business opening out before them.

Mr. Braithwaite suggested that the expenditure might be still further reduced, and said he could see no reason why it should continue at so large a sum as £700 per annum.

The Chairman pointed out what Mr. Braithwaite appeared to have lost sight of, that the company was still doing business, as appeared from the statement made by their manager.

Mr. Braithwaite explained that he understood Mr. Offor's remarks to apply to the South Eastern Company.

The Chairman said if they found after the Colchester experiment, and the Aylesbury installation had become generally known, that their business did not increase, they would then consider whether they would reduce the establishment altogether, and, so to speak, hibernate; if that time did arrive, they would certainly adopt a course of that description.

A vote of thanks to the chairman was then moved by Mr. Braithwaite, and, this being carried, the meeting terminated.

Indo-European Telegraph Company, Limited.

THE seventeenth ordinary general meeting of the members of this company was held at the City Terminus Hotel on Monday, Colonel Holland, chairman of the company, in the chair.

Mr. W. Andrews, managing director, having read the notice convening the meeting,

The Chairman moved the adoption of the report and statement of accounts. (The report was published in our issue of the 19th ult.) In doing so he said the leading feature of the accounts of the past year was one which directors, in the interests of shareholders, always liked. The year had been a quiet one, and had not been marked by any extraordinary events, so that the business had flown on unchecked to a prosperous and pleasant position. The profits made were nothing like so great as in the previous year, when they were altogether exceptional, the company having for some months had the whole business of conveying telegraphic messages from Europe to the East thrown upon it, in consequence of the wires of the other cables being destroyed or in possession of the enemy, and they would remember that that was done without any increase of cost, and, he might say, in a very efficient manner. The sum total of the receipts for the past year was £100,000, against £118,000, the difference of £18,000 marking the extra sum received for the extra work. The £100,000 could hardly be said to represent a very flourishing state of business, but trade had been very bad, and until there was an improvement in the general trade of the country, they could not expect the business of the company to be materially increased. The expenditure was a matter over which they had more control, and it might be interesting to them to know the total expenditure for the past four years: In 1880 it was £56,632; 1881, £57,875; 1882, £58,648; and last year, £54,754. Those expenses would remain practically the same if the company's business were doubled, as was shown last year on the total interruption of the Eastern Company's line, because staff and other arrangements had to be kept up to a minimum of efficiency which provided for the emergency of dealing with the total trade exchanged with India and the East if necessary. They proposed a dividend virtually of 8 per cent.; last year it was 9 per cent., but that was an exceptional year, and the shareholders had reason to be satisfied with 8 per cent. The long-looked-for termination of the absorption of their funds in connection with the Persian debt had come to an end, and the amount they had paid would, for the next 11 years, be repaid in sums a little under £2,000 annually. A branch office had been opened in Mincing Lane, and a special wire from the Post Office had been leased in connection with it. This was part of a measure constantly engaging their attention: to make the business of the company more "come-at-able" at all times, to improve the efficiency, and to place the means of communication in the hands of merchants in all parts of London as completely as possible; it was on the efficiency of their working that their success depended. They had also to notice with satisfaction the conclusions arrived at by the Cables Conference for the protection of submarine cables, for the regulations passed would to a great extent reduce the chances of injury to cables for the future. Colonel Holland then alluded to the loss of Sir William Siemens, and of the Hon. Robert Grimston, the first chairman of the company, by death. Few men, he said, had combined, as Sir William Siemens did, the greatest scientific skill with the power of applying that skill; he was both a most able scientific observer and a practical man of science besides, and his death was a national loss. Mr. Grimston held office in the company during the hard times preceding the dividend-paying period, and had to go through the whole of the hard work and the unremunerative part of the business, and therefore he often had a very ungracious and painful office to perform in coming before the shareholders with an empty purse. But the

feeling he left behind with his late colleagues was one of warm affection, for he was not only a man of ability and energy, but kindly, genial, and upright, and he (the chairman) was sure the shareholders would join with the board in that expression of regret. He then moved the adoption of the report and accounts.

Mr. H. Weaver seconded, and the motion was carried unanimously.

The Chairman moved that a dividend be, and is hereby declared for the half year ending 31st December, 1883, of 17s. 6d. per share, making, with the interim dividend already paid, 6 per cent. for the year, and a bonus of 10s. per share, both free of income tax, making in all 8 per cent. for the year.

Mr. J. H. Tritton, seconded, and this was also carried.

The retiring directors. Messrs. H. Weaver and A. Delbrück, were re-elected, and the auditors, Messrs. Kemp, Ford, and Co., re-appointed at fees increased from 50 to 100 guineas per annum.

A vote of thanks to the board terminated the proceedings.

The Maxim-Weston Electric Company, Limited.

THE following is the report submitted to the shareholders of this company on Friday, the 2nd inst.:—

The directors beg to inform the shareholders that, in spite of the large sums expended in exhibitions and other purposes during 1881 and 1882, they have not received a single order as a result, and have consequently had to make a business. This, which under the most favourable circumstances is a work of time, has in the case of an electric light company been surrounded with difficulties which have rendered the task a particularly arduous one.

The directors have pleasure in stating that their operations for the year ending 31st March, 1884, have resulted in a profit of £2,065 16s. 3d., after deducting all expenses, and that, having removed to new works and offices of greatly reduced rentals, as well as having effected further economies, the expenses are now reduced to about one-half, and are not likely to exceed this during the ensuing year.

The directors consider that they may congratulate themselves in having attained to an hitherto unexampled result, by being able to show a net profit on the year's operations, which they think it is almost superfluous to state is due to the ability and continuous exertions of their managing director.

With reference to profit and loss account, the directors have written off nearly the full amount paid for the patents originally purchased by the company, then called the Electric Light and Power Generator Company; also the expenditure during 1881 and 1882 resulting in a deficit of £32,783 13s. 3d. They have charged the loss consequent upon realising the old plant, and by the surrender of the Bankside premises. It will be also seen that the shares in other companies received in respect of sales, concessions, and licenses have been reduced to a nominal figure.

The present directors have now sold all superfluous or abandoned apparatus (which was costing a large sum for storage), and all plant connected with the Maxim and Weston systems has been put in thorough working order. New plant, besides a complete stock of appliances, have been added, and the stock sheets have now been made up with a strict regard to realisable values.

Recent patented improvements in lamps, dynamos, and accessories have, since their receipt in this country (say in October of last year), enabled the directors to undertake lighting of every description upon terms which compare favourably with other contractors. The directors have pleasure in stating that they have received testimonials from every purchaser of installations, which have included the lighting of mines, mills, warehouses, docks, theatres, and private residences throughout the country, besides several shipping orders.

The directors recommend that the paid-up capital of the company be reduced to £100,000, by making the £1 shares fully paid 10s. fully paid, so as to make the capital of the company show what they now consider is its substantial value. If this reduction is approved of the directors hope that they will be in a position to declare a dividend for next year.

The directors are convinced that at no period in the company's history has the stock been intrinsically so valuable, and looking at the greatly enhanced value of the Maxim and Weston patents held by the company, owing to recent improvements which have rendered their arc and incandescent systems even more economical, reliable, durable, and efficient than formerly, consider they are warranted in auguring for the company a successful future.

The company is now in excellent credit; the relations with the parent company in America are of the most cordial character, and the company have ample stock and funds in hand to enable them to carry on a large and steadily increasing business.

N.B.—An exhibition of the company's new lamps, dynamos, and appliances will be given at their works on Wednesdays, 7th, 14th, and 21st May, open to shareholders and their friends.

The Submarine Cables Trust.

THE directors state that the accounts for the financial year to the 15th of April show a revenue, including the balance brought forward, of £26,176. The dividend and bonus on the Eastern Extension Company's shares (£3,651 9s.) and the dividend on the Eastern Company's shares (£1,350 12s. 6d.) in respect of profits to the 31st of December last, although not paid until after April 15, were declared prior to that date, and are, therefore, as usual, included in the revenue for the past financial year. The expenses amounted to £1,323, and the payment of two half-yearly Coupons at the rate of 6 per cent. per annum absorbed £20,340, leaving £3,943 to be carried forward.

Telegraph Construction and Maintenance Company, Limited.—The 18th distribution on the certificates issued under the trust deed of the 12th March, 1875, will be made on and after the 1st May, 1884. The distribution, which arises from dividends on the shares held by the trustees, will be at the rate of 1s. per £5 certificate, payable two clear days after presentation of coupon No. 18, at Messrs. Barclay, Bevan & Co.'s Bank, No. 54, Lombard Street.

The West India and Panama Telegraph Company, Limited.—The directors, after deciding to place £15,000 to the reserve, recommend a dividend of 6s. per share on account of arrears of dividend on the first preference shares.

Stock Exchange.—Application has been made to the Stock Exchange Committee to appoint a special settling day in the vendors' shares of the London and Globe Telephone and Maintenance Company, Limited.

The Stock Exchange Committee have appointed Monday, May 5th, a special settling day for Eastern Telegraph Company, Limited, 4 per cent. debenture stock, and other securities.

LATEST QUOTATIONS.

Authorised Issue.	Shares.	Name.	Paid.	Closing Quotations, April 30.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	8	2½ - 2⅝	
		Do. Do.	10	4 - 4½	
50,000	5	Australasian E. L., Power & Storage Co.	5	..	
24,900	10	British Insulite Co., Ld., "A" Shares	5	..	
30,000	5	Brush Elec. Lt. & Power Co. (Scotland)	2½	..	
25,000	5	Gt. Western Electric Light & Power Co.	2½	⅛ - ¼	
24,980	5	Hammond Elec. Lt. & Power Sply. Co.	5	¾ - 1⅛	
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	5	..	
250,000	1	Maxim-Weston Elec. Lt. & Power Co.	1	⅛ - ¼	
100,000	5	Metrop. Brush Electric Lt. & Power Co.	3	..	
40,000	5	Pilsen-Joel & Gen. Elec. Lt. Co.	2½	..	
20,000	5	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.	3	1⅛ - 1⅜	
		TELEGRAPHS.			
1,892,480*l.*	Stk.	Anglo-American, Limited	100	34 - 35	34½
2,553,760*l.*	Stk.	Do. Pref. } Def. receiving no div. until	100	62 - 63	62½
2,553,760*l.*	Stk.	Do. Def. } 6 p. c. paid to Pref.	100	7⅝ - 8	
130,000	10	Brazilian Submarine, Limited	10	10 - 10½	10⅜
16,000	10	Cuba, Limited	10	9⅝ - 10⅛	
6,000	10	Do. 10 per cent. Preference	10	16½ - 17½	
13,000	10	Direct Spanish, Limited	9	4 - 4⅛	
6,000	10	Do. 10 per cent. Preference	10	13½ - 14½	14
65,000	20	Direct United States Cable, Ld., 1877	20	9⅛ - 10⅛	
100,000*l.*	100	Do. 6 per cent. Deb., repayable 1884	100	98 - 102	
380,000	10	Eastern, Limited	10	10⅞ - 11	11, 10⅞
70,000	10	Do. 6 per cent. Preference	10	13 - 13½	13⅛
200,000*l.*	100	Do. 5 do. Debs., repayable Aug. 1887	100	101-104	102½
200,000*l.*	100	Do. 5 do. do. Aug. 1909	100	102-106	
250,000	10	Eastern Exten., Australasia & China, L.	10	11⅛ - 11⅜	11⅜
320,000*l.*	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	107 - 110	108
500,000*l.*	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	102 - 105	
140,000*l.*	100	Do. do. reg., repayable 1900	100	102 - 105	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 - 105	
850,000*l.*	100	{ Eastern & South African, Ld., 5 p. c. } { Mort. Deb. Rg. redeemable 1 Jan. 1900 }	100	103 - 106	
	100	Do. do. To Bearer	100	103 -106	104
20,050	10	German Union Telegraph & Trust, Ld.	10	9⅞ - 10⅛	
250,000	10	Globe Telegraph & Trust, Ld.	10	6¼ - 6⅜	6⅜, ¼
250,000	10	Do. 6 per cent. Preference	10	12⅝ - 12¾	12¾, ⅝, ⅝, ¾
150,000	10	Great Northern	10	13⅜ - 13⅝	13⅜
100,000*l.*	100	Do. 5 per cent. Debentures	100	101 -104	
300,000*l.*	100	Do. 5 per cent. Debentures	100	101 -104	
81,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	22½ - 23½	
100,000	100	Do. 6 per cent. Debs., 1888	100	100 -103	
18,000	25	Indo-European, Limited	25	30½ - 31½	31½
40,000	10	London Platino-Brazilian, Limited	10	3½ - 4	
100,000*l.*	100	Do. 6 per cent. Debentures	100	99 -102	
12,000	10	Mediterranean Extension, Limited	10	1½ - 1⅝	
3,200	10	Do. 8 per cent. Preference	10	2 - 4	
10,000	8	Reuter's, Limited	8	8½ - 9	
238,225*l.*	Stk.	Submarine	100	155 -165	155, 60
75,000	1	Do. Scrip	1	1⅛ - 1¼	
4,200	Cert.	Submarine Cables Trust	100	97 -100	
37,350	12	Telegraph Construction and Mainten.	12	33 - 34	33½
150,000	100	Do. 6 per cent. Bonds, 1884	100	107 -109	
186,750	5	Do. 2nd Bonus Trust Cert.	2½	1½ - 1⅝	
30,000	10	West Coast of America, Limited	10	6½ - 6⅞	
150,000*l.*	100	Do. 8 per cent. Debs.	100	108 -110	
45,791	15	Western and Brazilian, Limited	15	5⅛ - 5⅜	5⅛, ¼
24,119	7½	Do. Preferred	7½	4⅝ - 4¾	
24,119	7½	Do. Deferred	7½	⅛ - 1⅛	
200,000*l.*	100	Do. 6 p. c. Debs. "A" 1910	100	102 -105	
250,000*l.*	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	98 -101	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	124 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -106	
86,321	10	West India and Panama, Limited	10	¾ - 1	
34,565	10	Do. 6 per cent. 1st Preference	10	6¾ - 7	
4,669	10	Do. 6 do. 2nd do.	10	4¾ - 5	
		TELEPHONES.			
224,850	1	Con. Tele. & Mainten., L., Nos. to 154,165	1	⅜ - ½	
225,000	1	Oriental Tele. Co., Nos. 80,001 to 300,000	¼	⅛ - ⅜	
100,000	5	United Telephone Co.	5	8 - 8⅛	
20,000	5	Do. New, issued 2 p.m.	2	..	

TRAFFIC RECEIPTS.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending April 18th, 1884, were £2,409, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending April 25th, were £2,327 after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited,

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph-Engineers and Electricians.

AN ordinary general meeting of this society was held on Thursday, April 24th, Professor W. G. Adams, F.R.S., president, in the chair. The minutes of the last ordinary general meeting having been read and confirmed, and the list of new, and proposed new members announced, a paper was read by Mr. T. H. BLAKESLEY, M.A., on "The Relation which should subsist between a Current of Electricity and the Conductor employed to convey it." The author in his paper showed the fallacy of the ordinary modes of quoting the economical law of Sir William Thomson, and assigning a fixed value to the current density.

In the discussion which followed the reading of Mr. Blakesley's paper,

Mr. W. H. PREECE said with reference to Professor Forbes's paper which had been read at the last meeting, that he considered the physics of the paper unimpeachable, but with the practical points at issue he entirely disagreed with Professor Forbes. Before entering into this question he would draw the attention of the meeting to the fact that a volume, consisting of a reprint of all Joule's most valuable papers had recently been published by the Physical Society. He had a short time ago made some experiments to determine the size of platinum wire which it would be best to employ in lightning protectors for protecting submarine cables at the point of their junction with land lines. The strongest current which it was possible to send out from a working telegraph battery was about 500 milliampères, whilst 30 or 40 ampères might be generated by the action of lighting, hence it was necessary to find the gauge of the wire which would not fuse with the working current, but which should be melted immediately the lightning current reached a dangerous strength. Wires down to half a mil diameter were experimented with. The results of the experiments seemed to show that the fusing current varied directly as the diameter of the wire. He would point out the fact that alternating currents heated a wire more than direct currents. Professor Forbes in his paper had dealt more with the question of safety than of economy. The generation of heat in the leads of an electric light system meant so much wasted energy. Edison found that five-eighths of the power expended was lost in heating the leads. The waste depended directly on the length of the conductors. If a conductor 2,800 centimetres broad, and 1 centimetre thick, carrying 70,000 ampères of current, were employed as suggested by Professor Forbes, the cost per mile of such a conductor, if it were of copper, would be no less than £350,000, whilst the cost of the insulating dielectric would be as much again; and as two conductors would be required for each mile, the total cost would amount to £1,500,000 per mile for conductors alone. The energy wasted in the conductor would amount to 6,750 H.P. per mile, which would be equivalent to £65,000 per annum. If electric lighting were carried out on such lines, the gas companies had not much to fear. Small conductors, worked with high tension currents, would be the only economical method to adopt.

Mr. A. TROTTER explained the construction of a table which showed graphically the results of various experiments which had been made on the heating of wires by electric currents, and which also showed the safe diameters proposed by various experts for electric light leads.

Mr. H. TAYLOR said that the results of numerous experiments made by him showed that for a given temperature the energy varied as the square root of the diameter of the wire; the results never disagreed more than 3 per cent., and therefore the law may be regarded as established. The measurements were made by determining the temperature from the change of resistance in the wires, a method which gave results to a degree of accuracy of at least 1 per cent.

Mr. R. E. CROMPTON said that he thought Professor Forbes's paper was somewhat spoilt by his summing up his conclusions so as to arrive at an utterly unpractical result. The simile of large conductors with large gas mains was an incorrect one, for the gas mains acted as reservoirs, as well as conductors of the gas. It should not be lost sight of that gas works were put at a distance from towns simply because the process of manufacture of gas was a noisome one, which was not the case with the electric light. Flat strips of metal were preferable for conductors, not only on account of their radiating surface, but also because they were actually the cheapest to employ. At the Law Courts flat copper strips, 8 inches by four-tenths of an inch were employed as mains. These strips would carry 500 ampères of current safely. For dynamo machines, ·06 inches was a usual size to employ with safety on the armature. He would point out that in order that heat may be freely radiated, the insulating covering of the conductors should be a good conductor of heat, and therefore cotton was not a suitable substance to employ.

Mr. CARUS WILSON pointed out that Professor Forbes had not given a table of the conductivity to heat of different materials. This, he thought, was an important omission.

Professor FORBES, in replying, said that his attention had been called to various articles in different journals, in which some of the laws which he had thought he had announced for the first time, had been already enunciated. For instance, in a series of articles on "Electric Lighting by Incandescence," by Mr. Kempe, which had been published in the ELECTRICAL REVIEW in 1882, the law—that the heating of a wire to a definite temperature varied as the current squared, and as the diameter cubed—had been worked out. With reference to Mr. Preece's remarks on the impracticability of employing conductors and currents of the dimensions mentioned in his paper, he would state that such dimensions would have to be employed if the provisional orders of the Board of Trade had to be followed.

The meeting then adjourned.

NEW PATENTS—1884.

6404. "Method of, and apparatus for determining the true constant of an electrical circuit." T. H. BLAKESLEY. Dated April 16.

6410. "Breaking electric contact to prevent overheating by imperfect contact." Sir W. THOMSON. Dated April 16.

6412. "Safety electric current stopper." Sir W. THOMSON. Dated April 16.

6413. "Electrical machinery or apparatus for generating, transmitting and measuring power." W. B. BRAIN. Dated April 16.

6414. "Process and apparatus for the extraction of metals from alkaline combinations by means of the electrolyte." L. A. GROTH. (Communicated by R. Grätzel.) Dated April 16.

6425. "Electric battery." W. A. BARLOW. (Communicated by C. Ganzentis.) Dated April 16.

6445. "Electric block signals for railways." A. M. CLARK. (Communicated by S. J. Savage and J. C. Lane.) Dated April 17.

6478. "Electrical signalling and stopping apparatus, chiefly designed for preventing collisions on railways." W. R. LAKE. (Communicated by R. Snyers.) Dated April 17.

6566. "Mounting electric incandescence lamps." A. M. CLARK. (Communicated by J. M. A. G. Lescuyer.) Dated April 19.

6570. "Electric apparatus for stopping motors instantly." H. PATAKY. (Communicated by G. Printz.) Dated April 19.

6590. "Telegraphic apparatus." R. K. BOYLE. Dated April 19.

6615. "Ammeters and voltmeters." E. J. PATERSON. Dated April 21.

6644. "Electric cables and lines of electric communication and prevention of induction therein." S. F. SHELBOURNE. Dated April 22. (*Complete.*)

6646. "Construction and regulation of secondary voltaic batteries." H. F. JOEL. Dated April 22.

6647. "Insulating material or articles." J. A. FLEMING. Dated April 22.

6649. "Preparation or production of insulating materials or articles." J. A. FLEMING. Dated April 22.

6734. "Electric generators, and applying fluid pressure to drive them." Hon. C. A. PARSONS. Dated April 23.

6736. "Process of decomposing metallic haloid salts by electrolysis." C. HOEPFNER. Dated April 23.

6738. "Communicating in trains by means of electric bells." J. E. DEAKIN. Dated April 24.

6739. "Receiving electric or other telegraphic signals or messages." M. GILL. Dated April 24.

6770. "Electricity counter." H. ARON. Dated April 24.

6772. "Magnetic and electric apparatus for the treatment of the nerves and muscles connected with the human eye and ear." S. MASON, C. R. HUXLEY. Dated April 24.

6863. "Galvanic batteries." J. WETTER. (Communicated by E. Vohwinhel.) Dated April 26.

6876. "Galvanic batteries." A. SCHANSCHIEFF. Dated April 26.

6886. "Regulating, measuring, or indicating electric currents applicable for use with dynamo-electric machines supplying numerous incandescent lamps, and for other purposes." A. B. HOLMES, J. C. VAUDREY, A. WATT. Dated April 28.

6877. "Incandescent electric lamps." H. WATT. (Communicated by E. Weston.) Dated April 26. (*Complete.*)

6908. "Electro-magnetic exercising apparatus adapted to the generation of electrical currents for hygenic and other purposes." H. J. ALLISON. (Communicated by J. H. Shaw.) Dated April 28.

6910. "Electric arc lamp." H. TROTT, C. F. FENTON. Dated April 28. (*Complete.*)

6949. "Preventing retardation in electric cables." S. F. SHELBOURNE. Dated April 29.

6984. "Electric regulation of prime movers." O. WEISS. Dated April 29.

6996. "Telephone receivers." A. M. CLARK. (Communicated by D. G. Barnard.) Dated April 29. (*Complete.*)

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

4037. "Electric secondary or storage batteries." R. H. COURTENAY. Dated August 21. 2d. Relates, firstly, to a method of preventing or lessening the leakage of the electric current in electric secondary or storage batteries when such batteries are charged but not in actual use. The object of the second part of the invention is to improve the condition of secondary or storage battery cells; that is to say, to render them more suitable for receiving an electrical charge. Another part of the invention relates to an improved method of construction of secondary or storage batteries, by which portability is obtained as well as large surfaces for storage capacity. (*Provisional only.*)

4104. "Appliances for hanging electrical lamps." T. T. SMITH. Dated August 24. 6d. The object of the present invention is to provide inexpensive and efficient means for suspending incandescent and other electric lamps from ceilings and other points of attachment, which will permit of the position of the lamps being adjusted vertically without interrupting the continuity of the electrical circuit, and will enable the said lamps and their fittings and supports to be readily detached and removed.

4110. "Electro-telegraphic system particularly applicable for long cables." A. GUATTARI. Dated August 24. 4d. Relates to a new electro-telegraphic system particularly applicable to long submarine cables, but also applicable for land lines, and it has for its object to produce at any distance a mechanical movement of sufficient energy and amplitude to set in motion any suitable kind of printing telegraphic instrument, without the line current having to produce any mechanical movement neither galvanoscopically nor electromagnetically by attraction or by neutralisation, so that however feeble may be the current, and however short its duration, the desired effect shall nevertheless be inevitably and instantaneously produced. (*Provisional only.*)

4120. "Automatic electric signals for railways." L. PISKORSKI. Dated August 25. 2d. Consists of an arrangement by which whenever two engines approach each other, either on the same lines of rails or on lines which converge and unite, or cross each other, a bell on each of the engines so approaching will be set ringing, and will continue to ring until one of the two engines has passed away. (*Provisional only.*)

4148. "Electrolytic treatment of saccharine solutions." L. H. DESPEISSIS. Dated August 28. 2d. Has for its object the removal and separation of those saline and earthy constituents, and the consequent liberation of the sugar which they prevent from crystallising and which can thus be extracted with comparative ease and economy. (*Provisional only.*)

4171. "Electrical insulators." J. H. JOHNSON. (Communicated from G. Westinghouse, junior, of America.) Dated August 29. 2d. The inventor takes a material having sulphate of lime for its base, such as gypsum or plaster of Paris or the like, and after cutting or forming the same by turning or otherwise treating it to form it as required, he submits it to a process of dehydration to expel a great proportion of the moisture. (*Provisional only.*)

4180. "Apparatus for automatically opening, closing, and controlling or directing electric circuits." F. C. PHILLIPS. Dated August 29. 2d. According to the invention the varying weight of one or more plates of a secondary battery or other battery or of an ordinary electrolysis cell is utilised for automatically controlling an electric circuit. (*Provisional only.*)

4197. "Secondary batteries." D. G. FITZ-GERALD and T. J. JONES. Dated August 30. 2d. Consists in the construction of certain portions of the anode element of an alloy of platinum and lead in certain definite proportions such that the alloy can be rolled, perforated and worked in the cold, and will resist the effects of local action under the circumstances above referred to. (*Provisional only.*)

4219. "Voltaic piles." E. EDWARDS. (A communication from abroad by A. Schroeder, of Germany.) Dated September 1. 2d. Relates to voltaic piles in which electricity is generated by means of a series of pairs of plates of dissimilar metals, separated from each other, and kept damp by a suitable excitant, and it has for its object a novel method of constructing and arranging such voltaic piles so that a current of electricity distributed over a wide surface may be imparted to any object simply by placing the pile upon such object. (*Provisional only.*)

4220. "Transmitting signals by means of electricity." A. F. ST. GEORGE and C. A. MCEVOY. Dated September 1. 2d. Relates to novel methods of and apparatus for transmitting electric telegraphic or telephonic signals or messages without the use of any connecting wire between the two points between which it is desired that such signals or messages shall be transmitted. The inventors employ, instead of a wire between the two places to be connected, a conducting medium, such as water, moist air, fog, mist, or clouds, and the earth. (*Provisional only.*)

4243. "Galvanic Batteries." A. GUTENSOHN. Dated September 3. 4d. The inventor takes a negative pole of zinc preferably in the shape of a bar or plate of any convenient size and shape to suit the cell of the battery in which it is to be used, but preferably about half an inch thick. Round this zinc he casts a mantle or sheath of metallic lead, preferably about one eighth of an inch thick, and covering the zinc with the exception of a small space at the bottom, where the latter is left exposed in order that an exciting liquid in which the compound pole is immersed may have access to the zinc. As an exciting liquid for this purpose, he prefers to use a solution of nitrate of lead, which has the property of attacking and dissolving the zinc, but has only very slight action upon the lead.

4247. "Telephone transmitters." C. A. ALLISON. (Communicated from abroad by D. Drawbaugh, of America.) Dated September 4. 8d. The invention consists:—1st. In a telephone transmitter, having in combination with its diaphragm or diaphragms a series of blocks or pieces of low conducting material the initial pressure between said blocks being maintained by gravity. 2nd. In the construction whereby the box of the instrument is supported at a distance from the back board so that a sound-receiving chamber is formed between said back board and the rear diaphragm, and also in the sound reflector, and the chamber thereby formed between the inner periphery of said reflector and the exterior of the enclosing case, whereby the sound-waves entering between the box and the reflector are reflected into the space between the rear diaphragm and the back board, and concentrated upon said diaphragm. 3rd. In the construction whereby the vibrations of the diaphragm simultaneously cause induced magnetic currents in an electro-magnet, and modifications in a local circuit passing through electrodes of low conducting material, the modified and induced currents uniting upon the line.

4269. "Electric lamps." A. W. RICHARDSON. Dated September 5. 2d. Relates to electric lamps of the "arc" class, and consists in arrangements by which the carbons or other equivalents therefor used in such lamps are enabled to be maintained in position for obtaining a light of greater steadiness and uniformity than has hitherto been practicable. (*Provisional only.*)

4276. "Electrical switches, chiefly designed for use with telephonic apparatus." H. H. LAKE. (Communicated from abroad by C. W. Holden, of America.) Dated September 5. 1s. 2d. Relates to switches both for telegraphic and telephonic purposes, but are more especially designed for telephonic circuits and instruments.

4281. "Electric lamps." J. R. P. WALLACE. Dated September 6. 6d. Relates to electric lamps in which the arc is regulated automatically by the action of the electric current producing the light, the arrangements being such that both the length of the arc, and the feed of the carbon electrodes producing the light, are regulated by the armature of a single electro-magnet actuated and controlled by the current of electricity passing through the lamp.

4297. "Supports or holders for telephonic instruments, &c." H. H. LAKE. (Communicated from abroad by C. W. Holden, of America.) Dated September 6. 10d. Relates to supports, more particularly designed for telephonic instruments, transmitters and receivers, either one or both, although they are also applicable for microscopic and other instruments of various kinds. The object of the said invention is to provide a support for such instruments which shall be capable of ready and easy adjustment in position for the convenient use of the instruments by operators.

4345. "Galvanic batteries." E. P. CHAIMSONOVITZ and T. ROWAN. Dated September 11. 4d. Relates to improvements in primary or generating batteries whereby the inventors produce a battery which is capable of generating electricity in large quantity and which has a small internal resistance which is not liable to polarisation and which will occupy but little space, and its electrical energy when exhausted can be easily and quickly restored. In carrying out the invention the inventors form the positive electrode of any of the oxides of lead, or spongy lead or other suitable oxides or metallic compounds or mixtures in any suitable state of division, and which may be mixed or not with any suitable inert substance. The negative electrode is formed of a plate or plates of zinc or other suitable metal and of any suitable shape or form. The exciting fluid is a solution of sal-ammoniac, but other suitable exciting substances may be employed.

4365. "Electric meters." P. JOLIN, J. PARSONS, and M. F. PURCELL. Dated September 12. 4d. The improvements constituting this invention consist, firstly, in the employment of an electro-magnet having a movable core to wind the spring of the clockwork mechanism through the medium of which the required measurement is effected and indicated on the dials of the counter. The coils around the cylinder or tube encircling the core of the said electro-magnet, which may conveniently be called the winding electro-magnet, may be made up of one wire only, or they may be made up of two wires, one of which is first wholly coiled upon the tube and the second coiled thereafter and in the same direction, or a layer of coils of each wire may be made alternately. Under a third method, two wires are coiled together and in the same direction. Under a fourth, two wires are coiled separately and in opposite directions, the wires being coiled either separately throughout or in alternate layers. (*Provisional only.*)

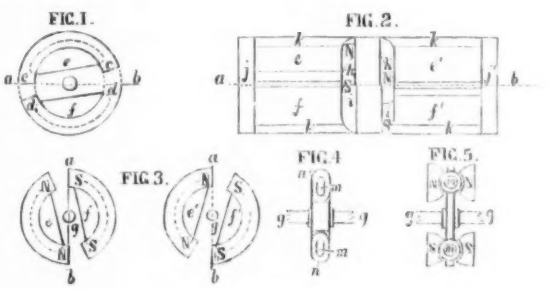
4453. "Apparatus for measuring electric currents and electromotive force." R. E. B. CROMPTON and G. KAPP. Dated September 18. 6d. Consists in improvements in apparatus for measuring electric currents and electromotive force, which improvements refer more especially to the subject matter of the Provisional Specification

filed by the inventors with their application for Letters Patent for "Improvements in apparatus for measuring electric currents and electrical pressure or potential" on the 13th day of April, 1883, and where a magnetic needle or a piece of soft iron, pivotted or suspended, is brought under the combined influence of an electro-magnet (I) which tends to make it point straight or direct from pole to pole, and of a coil or coils or part of a coil or single wire (II) which tends to deflect it from that position.

1884.

1453. "Invention for the better protection of the public from broken and falling telegraph or telephone wires." A. T. ARCHER. Dated January 15. 6d. A system of mutual support applied to two or more wires, as used for conducting electric currents, and consists of ferrules made of ebonite, gutta percha, or any other non-conductor of electricity, fixed tightly on the wires, over each other in such a way, that they may be tied together in groups—by straps or cords made of hair, silk, wool, or other non-conductor of electricity, coated with gutta percha—so that in the event of one wire breaking it would be supported from falling, through being tied to a group of others. Those fastenings to be placed at suitable distances apart, between the ordinary telegraph posts or supports.

2041. "Improvements in dynamo-electric and electro-motive machines." E. B. BRIGHT. January 24. 4d. In dynamo-electric or electro-motive machines, as at present constructed, in which continuous electric currents are generated or employed, there are neutral parts of the magnetic field between the opposite poles of the exciting magnets, amounting on the average to about a fourth of the whole. The armature coils passing through these neutral spaces are not only useless, but mischievous, inasmuch as they add to the resistance of the working circuit without contributing electromotive force to the general current, besides occasioning other electrical disadvantages. In the new invention the magnetic field is complete throughout an entire circle, divided in two parts by a sharply-defined line, the whole of the armature coils being thus rendered productive. The application of the invention to the ring type of dynamo machines will be understood by a reference to figs. 1, 2, 3, 4, and 5. The armature is caused to rotate between a pair or more of field-magnets, having iron flanges or pole-pieces, and so fixed in relation to each other that when one of the coils of the rotating armature is passing from the end of the pole piece of one polarity of the field magnet on one side of it, it is at the same time coming before the pole-piece of opposite polarity of the field-magnet on the opposite side. The arrangement of the field-magnets with their flanges or pole-pieces is shown in figs. 1, 2, and 3, where the zero line, *a*, *b*. indicates the position in the circle of rotation where the opposite poles end on one side and commence on the other. In fig. 1 the poles are shown at *c c*, *d d*. Any form of coil may be used; as for example, cylindrical, or oval in section, but the inventor prefers to employ coils



shaped in section in the form of a D, or bent low, as shown by the straight plain and curved broken lines surrounding the letters, *e* and *f*, in fig. 1, and *e*, e^1, and *f*, f^1 in fig. 3. A section of the shaft of the revolving ring armature is shown at *g* in figs. 1 and 3, the armature itself being omitted in order to show the inclined position of the pole-pieces as the field-magnets. Fig. 2 represents the arrangement of the field magnets and their pole-pieces in plan, in which *e*, *f* and e^1, f^1 represent the field-magnets, of which the respective poles are shown in front view at fig. 3. The centre of the armature shaft coincides with the dotted line, *a*, *b*, but the shaft and armature are not shown in order to render the arrangement of the field magnets more clear. The ends of the cores of the field-magnets are recessed, as shown by the curved broken lines surrounding *h*, h^1, and *i*, i^1, in order to concentrate the magnetism on the faces of the pole-pieces, which are adjacent to the armature. *j*, *j*, are iron yokes uniting each pair of field magnets, and secured to, or forming part of the bed plate, *k*, *k*, *k*, *k*. Fig. 4 shows in section a suitable form of flat ring armature, adapted to fig 2; *g*. *g*, being part of the shaft, *m*, *m*, the core of the armature, and *n*, *n*, the surrounding coils of wire. In fig. 5 is shown a ring armature with coils circular in section, in which part of the shaft is lettered *g*. *g*, and the core of the coils of the armature *m*, *m*. To this form of armature the inventor has applied a special shape of pole-pieces of the field-magnets, shown in section at N, N, S, S, by which the magnetism is intensified upon the exposed portion of the armature coils, and which is one part of the improvements.

CORRESPONDENCE.

Telegraph Wires.

Could you tell me what kind of wire at present made requires the least dip, and where it is to be procured? I require it for long telegraph spans where smallness of sag is all important.

A. J.

[Silicium bronze wire is the best for the purpose. It may be procured from the Phosphor Bronze Company, 87, Sumner Street, Southwark.—EDS. ELEC. REV.]

The Theory of Dynamo-Electric Machines.

Allow me to draw your attention to a typographical error which occurs in my letter upon the above subject published in your issue of last week. Instead of "the direction of the magnet upon the wire," read "the direct action of the magnet upon the wire."

F. de Wolffers.

The really pretty, not to say highly decorative, diagrams of Mr. F. de Wolffers, by which he represents that ethereal something which we call magnetism by a lot of spikes and lines, are, I venture to think, likely to convey a wrong impression to the future electrical student, as to the nature of magnetic force and its action on a conductor moving under its influence.

As a working hypothesis, to some minds the line of force theory has no doubt helped in a great measure to explain magneto-electric phenomena; but like the Ampèrian hypothesis, in a few years it will have served its turn and will be swept into oblivion, and the question will probably arise whether it would not have been better to have contented ourselves with the simple phenomena presented to us as they *were*, rather than to have introduced such a laborious theory as the "line of force" involves.

We *do* know that magnetism is a polar force, or a directive force, or a force that possesses properties in one direction that it does not possess at right angles to that direction—its repellant and attractive properties. We also know that the latter are not apparent unless a part or one side of a magnetic circuit resides in a more magnetic substance than the other side; as, for instance, in a straight bar of iron. If the atmospheric space outside of the bar were as magnetic a medium as the iron, there could then be no such thing as repulsion and attraction of the iron rod. It would be the same as a closed iron ring magnetised by a continuous helix. In the latter, the internal magnetism is most intense, but no external polarity is evident. If the original loadstone had been similarly magnetically short-circuited, the world might have remained in ignorance of magnetism until Oersted discovered that iron filings would adhere to an electrical conductor. Who knows but that other polar forces exist which may be similarly disguised, and of which we are ignorant on that account?

The mere fact that a movable conductor intersecting magnetism at right angles to its polarity generates an electric current in a direction depending on the direction of movement, is sufficient to explain the physical action of all dynamo-electric machines. Why, then, is it necessary to introduce hypotheses that are calculated to convey a wrong idea of this invisible magnetic force? Would it not be better to keep the mind free of such graphic but dogmatic diagrams? We have no more grounds for delineating magnetic force by lines than have static electricity or gravitation. Oh, but iron filings are distributed in lines! True; but the movable coils of dynamo machines intersect *magnetism*, not iron filings. Mr. F. de Wolffers gives his lines a direction; they all go from N to S; another may reverse the order of things, and make them appear from S to N. Now what is the advantage of this direction; is it to assist one to decide on the direction of current

in the movable coils? If so, it would be advisable for an international commission to settle the point, viz., that the direction of lines of magnetic force be assumed to go from N to S. But what an unnecessary assumption this would be!

Under the above somewhat ambitious title, Mr. F. de Wolffers says he will "describe the action of some other types of dynamo-electric generators." The representation of the probable distribution of a static force in the mere skeletons of dynamos, can hardly be called a "theory of dynamo-electric machines."

E. L. Voice.

1, Francis Street, W.C.
April 28th, 1884.

The Heinrichs Dynamo.

I have noted your remarks as to the high percentage of conversion given by my machine, but I am not aware that "*several* small sources of loss have been eliminated in the method of measurement adopted."

As well known, the percentage of conversion is obtained when dividing the horse-power absorbed by the machine—minus the friction of the machine belt and shaft—into the total electrical horse-power; whilst the commercial percentage is obtained by dividing the total horse-power absorbed by the machine (the friction of the machine, belt, and shaft included) into the electrical horse-power of the external circuit.

As known to you, this has been done in all the calculations you published in your last issue, and I am not aware of "any" source of loss which has been eliminated.

To prevent your remarks to be misunderstood or misinterpreted, by me or any of your readers, I beg you to explain in your next issue which "small sources of loss" have been eliminated, and thus apparently enhanced the percentage of conversion of my machine.

Charles F. Heinrichs.

52, Woburn Place,
April 26th, 1884.

[Any small losses which may occur between the transmission dynamometer and the machine (such as, for instance, loss by transmission) are eliminated in the Prony brake test; but Mr. Heinrichs will find these items mentioned in the report published last week.—EDS. ELEC. REV.]

An Electric Tell-Tale.

I have received a copy of the preliminary prospectus of a company called "Webb's Electric Calculating and Check Till Company, Limited," which purports to be formed for the purpose of acquiring the invention known as Webb's New Automatic "Tell-tale Till." In the prospectus it is stated that Mr. Webb's invention "has received the high commendation of no less eminent electricians than Dr. Siemens and Professor Silvanus Thompson."

Will you kindly allow me to state, firstly, that I have never expressed my opinion either in favour of or against Mr. Webb's invention, for the simple reason that I have never yet seen anything of it; and, secondly, that the use of my name by the persons responsible for the issue of the prospectus is entirely unauthorised by me.

The prospectus also states that "this remarkable invention" makes "ample provision against dishonest and collusive devices." If this were so, I should not need to trouble you.

Silvanus P. Thompson.

University College, Bristol,
April 28th, 1884.

A Protest.

Under the above heading, in your issue of the 19th inst., is a letter written apparently by one who has a grievance against the Society of Telegraph Engineers. He has adopted the usual method in such cases of selecting only isolated sentences as best suits his purpose, and then hiding himself behind a *nom de guerre*, so that we are entirely unable to arrive at any conclusion as to whether he ever did a single thing to improve that which he condemns. As he very charitably makes a cushion of a communication of mine, with the exception of an important item, I will, with your permission, state in a few words this item.

A magnet within a coil of wire is deflected by the current passing along the wire of the coil so that the poles of the magnet always point to the poles of the coil bearing the same name, that is the S pole of the magnet points to the S pole of the coil, and the N pole of the magnet points to the N pole of the coil, hence the repulsion which always takes place between magnetic poles of the same name is in this case overpowered, or "masked," by the more powerful electromagnetic action of the current on the magnet.

Now will this judge of judges condescend to enlighten us by designating the book, pamphlet, or other printed paper, extending from Oersted, in 1819, to the present time, where this "ridiculous" action of the magnet within a coil of wire has been noticed. We have always been told that the N end of the magnet is attracted by the S end of the coil, and *vice versâ*.

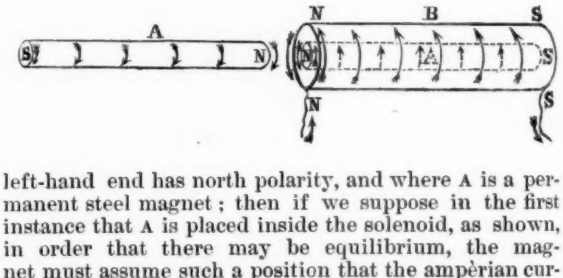
It may, perhaps, dawn on "Currente Calamo" that his *nom de guerre* may be applied to himself.

S. M. Banker.

April 23rd, 1884.

[We can quite understand our correspondent's vexation at "Currente Calamo's" letter, but must confess that in the main we agree with the substance of the same. Had Mr. Banker made himself properly acquainted with the elementary laws which govern the action of currents on currents (in other words the ampèrian theory, which is given in almost every electrical text book that we can recollect), he would have hesitated before committing himself in the manner he has done. It is, perhaps, unnecessary to say that the so-called discovery is only a discovery to Mr. Banker and to those who have learnt certain facts in electrical science without understanding the causes that produce them.

According to the ampèrian theory a magnetic bar or needle is the equivalent of a solenoid, if we assume the polarity to be caused by imaginary currents circulating round the bar. Referring to the figure, where B is a solenoid, traversed by an electric current so that the



left-hand end has north polarity, and where A is a permanent steel magnet; then if we suppose in the first instance that A is placed inside the solenoid, as shown, in order that there may be equilibrium, the magnet must assume such a position that the ampèrian currents become parallel and in the same direction to the actual currents in the solenoid, this can, obviously, only be the case when the two N and the two S poles correspond as shown. If, however, A is placed external to the solenoid (as shown to the left of the figure), then, if we have the two N poles contiguous to each other, we have the ampèrian currents in the magnet and the actual currents in the solenoid flowing in opposite directions, hence we must get repulsion. Thus the actual actions which take place are explainable, in fact are only explainable, by accepted laws without the dual action which Mr. Banker refers to, and which exists only in his imagination. Mr. Banker seems to have assumed that a pole is a sort of focus from which a radial action takes place in *every* direction, whereas actually this radial action, if it can be assumed, would take place *towards* the pole, along the bar itself, and then away from it at the extremity of the bar, like air or water, for example, rushing out of a perforated nozzle at the end of a tube.—EDS. ELEC. REV.]